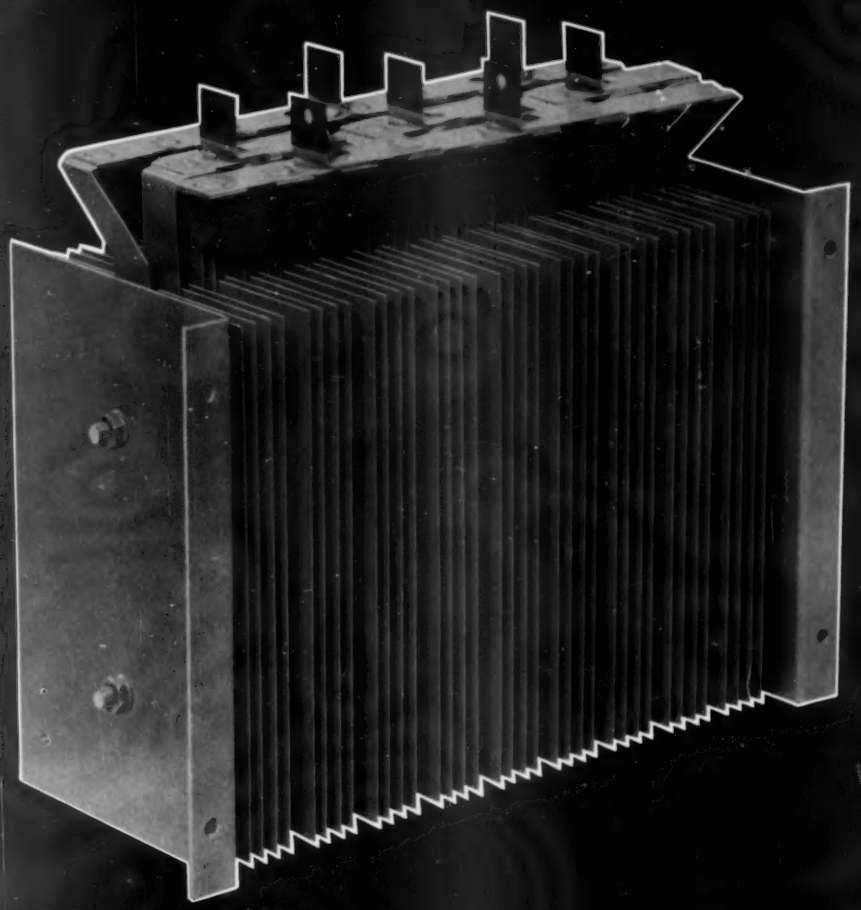
Welding Engineer

PRICE 50 CENTS

MARCH, 1959



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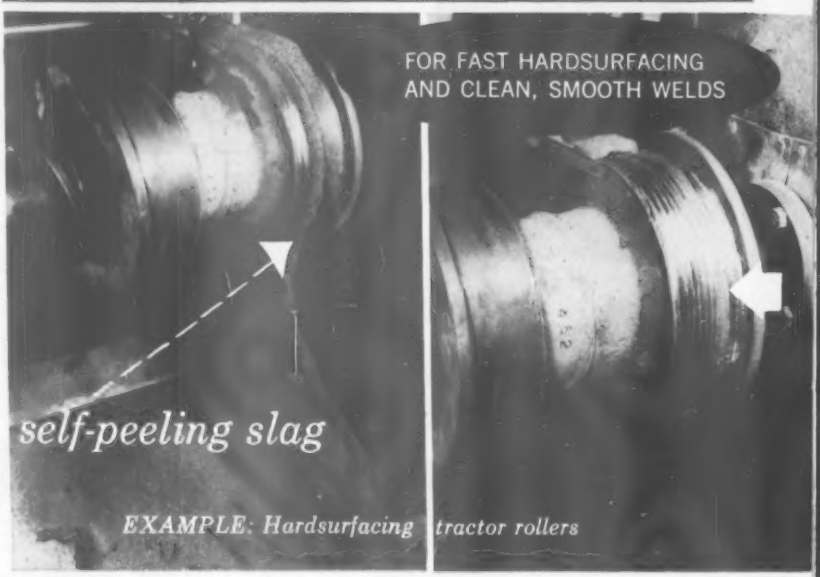

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NATIONAL WELDED PRODUCTS MONTH · APRIL 1958 ·

Vol. 44 — No. 3

Welding Engineer

The magazine of joining and severing materials

This is welding: March, 1959

Oxyacetylene torches straighten flame-warped steel 31

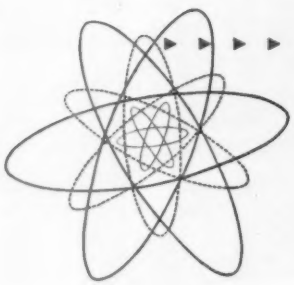
Part II—the completion of repairs and final cost details. This article on the application of flame-straightening to fire-warped hanger structures at McChord Air Force Base concludes a special *WE* report begun in the February issue (p. 40).

Filler metals for joining 36

In his 18th article in this series, **Orville T. Barnett** discusses soft solders, detailing their uses, chemical compositions, tensile strengths and availability of shapes and sizes.

Submerged-arc welding reclaims blooming mill rolls 38

When obsolete blooming mill rolls were ready to be scrapped, submerged-arc welding came to the rescue. **J. J. Matusek** reports on this reclamation of the 28-ton giants.



A guide to nuclear power—IV 40

Concluding his series on nuclear power, **W. D. Biggs** deals with thermonuclear fusion and the problems involved in producing sufficient energy to make this process both workable and economical.

Tubular construction takes hold in Germany 46

From its early beginnings to the present day, tubular construction has been recognized as nature's best design principle. Now its design advantages are making great in-roads in German fabrication.

Welding costs are high—here's why! 52

Bela Ronay gives a definitive report on the reasons behind so-called "expensive" welding. Six money-consuming practices are listed and corrective measures are outlined.

Also in this issue:

Mig welding fabricates a unique hull bottom 35

Missile welding headlines western metals show 44

Steam analysis now possible with welded stainless condenser 51

Transform a hole in the ground to a welded steel pool 56

Army, too, uses the welding shop 57

Army testing all-welded aluminum bridge trusses 59

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Safety, acetylene chemistry featured topics of IAA annual convention 62

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RW-25

JACKSON for ARC WELDING

Insulated Copper Alloy Holders have greatest strength, hardness and conductivity. Jackson insulators have highest heat and impact resistance. Choose them where greater duty cycles are called for.

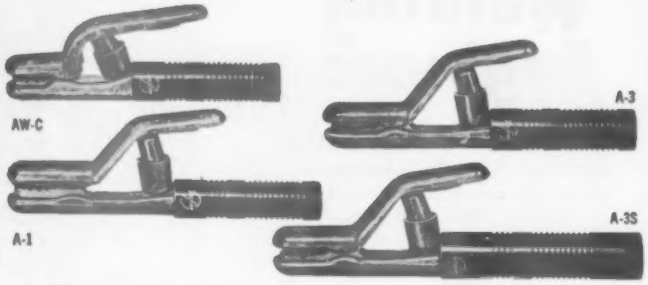
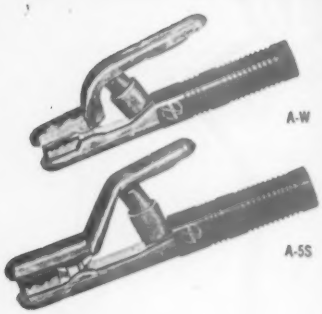


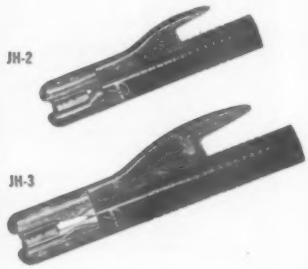
Table shows duty cycles possible with Jackson Insulated Copper Alloy Holders, using electrodes and cables shown.

Holder Class	Model	Electrode	Amps & Cable	Amps & Cable	Duty Cycle
Small	AW-C	7/32"	250—No. 1	300—1/0	50%
Medium	A-1	1/4"	300—1/0	350—2/0	50%
Large	A-3	3/8"	375—2/0	450—3/0	65%
Heavy-Duty	A-3S	3/8"	500—4/0		80%



Featherlight medium class model A-W takes electrodes through 1/4" at 300 amps, weighs 14 oz. Featherlight larger model A-5S has wider tong and wider handle, takes electrodes through 5/16" at 400 amps.

Featherlight Holders have tongs of aluminum alloy replaceable jaws of high-copper alloy. Excellent all-purpose holders, each within its rated capacity. Cable connection must be made mechanically.



Featherlight and streamlined, small class JH-2 takes electrodes through 5/32" at 200 amps, weighs 9 1/2 oz. Medium class JH-3 takes electrodes through 1/4" at 300 amps.

'Quik-Trik' Cable Connectors 2/0-R and 4/0-R have neoprene rubber insulators with tapered ends to stretch over cable snugly. They lock out moisture and dirt, don't catch against obstructions.

The Jackson
CABLEHITCH

Where welding is done above the level of the machine, Cablehitch suspends the cable near the work area. More cable may be pulled through; it will not slip back.

Cablehitch cuts operator fatigue, increases safety and efficiency, reduces cable wear. In one size to fit welding cables No. 1 through 4/0, gas and air hose 5/16" through 3/4" o.d.

Jackson Ground Clamps give broad metal-to-metal contact. They also fit the hand, go easy on, easy off. Angled socket reduces strain on cable, allows wire fastening for extra support of the cable.

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NEWS

FRONT row, left to right, E. C. Chapman, Combustion Engineering Inc., and one of the conference speakers, J. J. Chyle, A. O. Smith Corp. and former president of AWS, and Fred Plummer, national secretary of AWS, listen to W. A. Wilson, at right, Army Ballistic Missile Agency, at Midwest Welding Conference.

New welding uses told to 225 at Midwest Welding Conference

Approximately 225 persons were informed of up-to-date welding uses during the recent two-day meeting of the Midwest Welding Conference in Chicago. Twelve speakers presented as many papers on topics ranging from "Arc welding HY-80 and T-steels" to "Use of welding in highway construction."

This fifth in a series of specialized discussions that began in 1955 was once again co-sponsored by Armour Research Foundation of the Illinois Institute of Technology (site of the meeting), and by the American Welding Society's Chicago section.

Speakers for the first day of the meeting, January 28, included: R. C. Becker, International Harvester Co. ("Factors affecting the choice of gas-shielded metal-arc processes"); R. D. Thomas, Jr., Arcos Corp. ("Arc welding HY-80 and T-steels"); Clarence Jackson, Linde Co. ("Recent developments in welding abroad"); J. R. Wirt, Delco Remy Div., General Motors Corp. ("What about ultrasonic welding?"); J. D. Eyestone, Western Electric Co. ("Resistance welding applications at Western Electric Hawthorne Works"); A. W. Schueler, Precision Welder & Flexopress Corp. ("New developments in resistance welding").

Leading off the January 29th session was J. Mikulak of Worthington Corp., who spoke on "Economics of welded fabrication." Following him were R. H. Beeder, Atchison, Topeka & Santa Fe Railway System ("Welding rails for railroads"); C. R. Rea, Bridge Div., Texas Highway Dept. ("Use of welding in highway construction"); W. A. Wilson, Army Ballistic Missile Agency ("Practical aspects of welding in missile applications"); E. C. Chapman, Combustion Engineering, Inc. ("The case for stress relief annealing"), and L. J. Larson, Allis-Chalmers Mfg. Co. ("The case against indiscriminate use of stress relief annealing").

Serving as chairmen for the four morning and afternoon sessions were L. C. Monroe, publisher of *Welders Digest;* J. Ogden, Fisher Body Div., General Motors Corp.; R. R. Lincoln, Air Reduction Sales Co., and E. C. Bailey, Commonwealth Edison Co.

AWS expecting 15,000 at April welding show

The American Welding Society is expecting 15,000 persons to inspect the exhibits at the Society's welding show to be held April 7 to 9 in Chicago's International Amphitheater.

The National Spring Meeting of the AWS will be held during the show week, April 6 to 10, with meeting headquarters at the Hotel Sherman. The AIEE will hold an electric welding conference at the same time.

National Welded Products Month will be April this year. The AWS is sponsoring it to coincide with the show week, though the month was inaugurated by WELDING ENGINEER last September.

Canadian show, convention set for Toronto, May 5 & 6

The Canadian Welding Society will hold a convention and welding show, May 5 and 6, as part of the National Industrial Production Show of Canada, which will run during the week of May 4 in Exhibition Park, Toronto.

Sixteen speakers from Canada, the United States and Great Britain will present welding papers at the second annual National Welding Convention. Theme of the meeting is "Productivity via welding."

The welding exhibits will be housed in the Industry building on the exhibition grounds. The convention will be in the Coliseum building.

New England Welding expands facilities

New England Welding Supply Co., Inc., has expanded its facilities at a new location, 445 State St., North Haven, Conn., where the company has a new sales and distribution office.

New England Welding carries a complete line of Air Reduction Sales Co. products and medical gases supplied by Ohio Chemical & Surgical Equipment Co., a division of Airco.

Armour combines three divisions

Armour & Co., Chicago, has combined its coated abrasives, cushioning products and adhesives operations to form the Armour Alliance Industries.

Carl B. Johnson is general manager of the new division and R. W. Gutheil is marketing director.

PART of grid system of welded carbon steel piping embedded in concrete in 22-lane toll plaza area on Chicago's new Calumet Skyway bridge. Here, welder connects 90 deg elbow. Welding fittings were manufactured by Tube Turns, Louisville. Heated oil circulates through leakproof piping to keep 58,500-sq-ft area ice-free during winter. Piping contractor was Chicago Conditionaire Co.

Airco completes oxygen plant in Kansas City

Air Reduction Sales Co., New York City, recently completed a plant for the production of high purity oxygen and nitrogen at Kansas City, Kan. The new facility replaces a plant in Kansas City, Mo., which has been closed.

SYLVANIA-Corning Nuclear Corp., Bayside, N. Y., has been awarded a contract to manufacture nuclear fuel elements for Army Package Power Reactor-I located at Ft. Belvoir, Va. Dr. L. Davenport on left, president, and S. Roboff, director of marketing, examine a Sylcor fuel element made by brazing 18 flat plates to a pair of side-plates. Core of flat plates is enriched uranium dioxide, boron carbide and stainless steel powder clad with stainless steel. Complete fuel load for reactor requires 38 elements as one above.

WORKMAN holds titanium head shape said to be the largest ever produced. Head weighs 25 lb, is 37 in. in diameter and has a wall thickness of 0.058-in. Two titanium sheets were welded together to provide a blank for pressing much larger than are normally available. Lukens Steel Co. produced head for Curtiss-Wright Corp.

COMING EVENTS

MARCH 9-10: IAA 1959 Convention, Roosevelt Hotel, New Orleans.
MARCH 12: NEMA Arc Welding Section Quarterly Meeting, Pittsburgh.
MARCH 16-20: ASM Western Metal Exposition and Congress, Pan-Pacific Auditorium and Ambassador Hotel, Los Angeles.
APRIL 6-10: AWS National Spring Meeting, Hotel Sherman, Chicago.
APRIL 7-9: AWS Welding Show, International Amphitheater, Chicago.
APRIL 16-30: Engineering, Marine, Welding and Nuclear Energy Exhibition, Olympia, London, England.
APRIL 18-22: ASTE Annual Meeting, Schroeder Hotel, Milwaukee.
MAY 4-6: NWSA Annual Convention, Fairmount Hotel, San Francisco.
MAY 5-6: Canadian Welding Society, Second Annual Welding Convention, Exhibition Park, Toronto.
MAY 5-6: Canadian Welding Society, Welding Show, Exhibition Park, Toronto.
MAY 25-28: Design Engineering Show and Conference, Convention Hall, Philadelphia.
JUNE 4-5: NEMA Arc Welding Section Quarterly Meeting, Hot Springs, Va.
SEPT. 28-OCT. 1: National Fall Meeting of the AWS, Detroit.
NOV. 2-6: 41st National Metal Exposition and Congress, International Amphitheater, Chicago.

NCG opens Charleston, Cleveland offices

National Cylinder Gas Div. of Chemetron Corp., Chicago, has established new sales offices in Charleston and Cleveland.

The Charleston sales office and new warehouse will handle the sales and service of industrial gases, cutting and welding equipment and other NCG products. The warehouse will also provide storage for the company's branch office in Savannah.

The new Cleveland office replaces quarters in the Terminal Tower Building. This office will supervise sales and service of industrial and medical gases and equipment for metal working and allied industries.

Barnett filler metals book to be published

"Filler metals for joining," a book by Orville T. Barnett, Armour Research Foundation of the Illinois Institute of Technology, Chicago, was to be published in February by the American Welding Society.

The book summarizes the industrial practices in selecting filler metals for all joining problems, and emphasizes products for manual and automatic arc welding.

The book has appeared serially in WELDING ENGINEER over the past several years. The articles were published under the same title, "Filler metals for joining."

Welding included in Great Britain show

Pipe welding, flame cutting and recent advances in welding will be shown at the Engineering, Marine, Welding and Nuclear Energy Exhibition at Olympia, London, April 16 to 30.

More than 500 firms will exhibit in three halls covering 250,000 sq ft. Though all the firms are not welding equipment manufacturers, many of the firms in the marine, nuclear energy and related fields use welding and flame cutting in manufacturing their products.

The use of welding in manufacturing, and demonstrations of such use will be the subject of many of the exhibits.

King-Size tank cars put in use by ACF

Prototypes of King-Size all-welded steel tank cars for shipping chemical, petroleum and food products have been put in use by Shippers' Car Line Div. of ACF Industries Inc., New York City.

The two cars, whose 16,000 and

(Continued on page 76)

C. E. MONLUX, Linde Co., at left, was elected president of the Compressed Gas Association at its recent 46th annual meeting in New York City. Other officers elected are, from left, G. Cusack, Pure Carbonic Co., first vice president; D. Horner, Harrisburg Steel Co., second vice president and F. Fetherston, secretary-treasurer.

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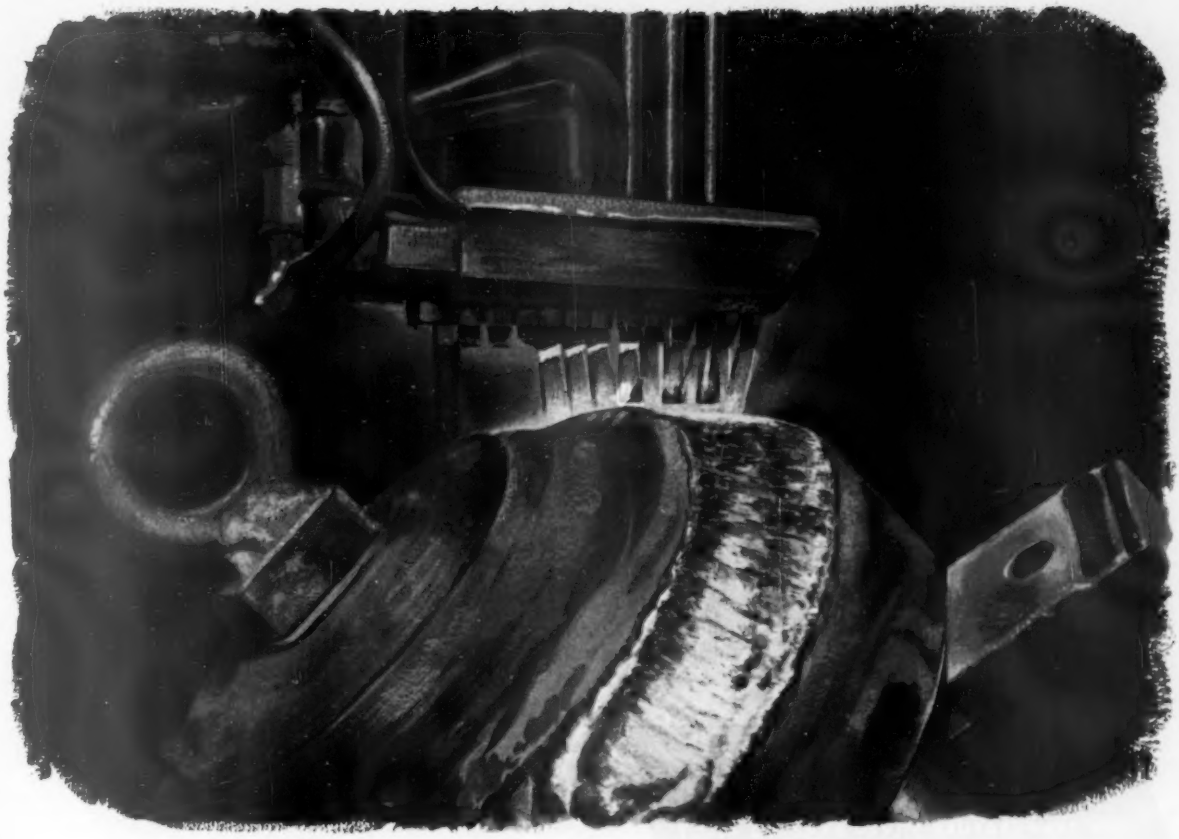
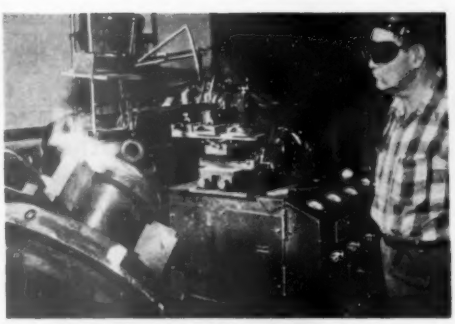


Mechanized Hard-Facing Saves Money



A 25% saving in rod was realized by mechanizing the hard-facing of this valve disk. Time required to complete operation was cut from 2½ hours to ½ hour.

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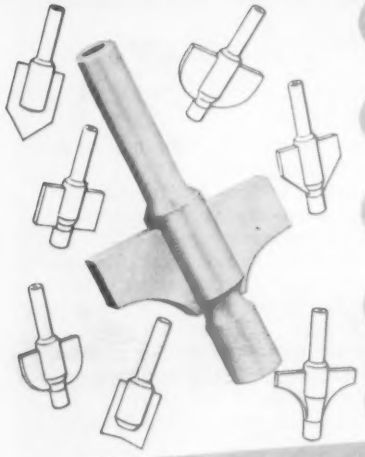
SILVALOY

LOW TEMPERATURE SILVER BRAZING ALLOY

The Millers Falls Company is a leading manufacturer of quality hand and power tools for home and industry for over 90 years.



MILLERS FALLS TOOLS
SINCE 1868

AMERICAN PLATINUM & SILVER DIVISION

ENGELHARD INDUSTRIES, INC.

EXECUTIVE OFFICES:

113 ASTOR STREET • NEWARK 2, NEW JERSEY

THE SILVALOY DISTRIBUTORS

A.B.C. METALS CORPORATION
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LICENSED CANADIAN MANUFACTURER
ENGELHARD INDUSTRIES OF CANADA, LTD. • TORONTO • MONTREAL

Two complete reference manuals for low-temperature silver brazing and fluxing are available upon request. Send for either one or both. ★ ★ ★ ★ ★ ★ ★

WELDING ENGINEER

Your March, 1959

Weld World

As WE went to press, these were the industry's latest developments:

. . . U. S. Steel Corp. has introduced vinyl-coated steel sheet that is weldable . . . current flow must be controlled from back side. More on this next month.

. . . If our informants are correct (and they usually are), you can expect another trade association to be formed soon in the welding industry.

. . . Metal & Thermit Corp., contrary to rumors, is NOT going out of the welding equipment business. Officials of M&T have asked that Welding Engineer make this clear . . . the rumors are absolutely false.

. . . "Stellarweld" and "Vega" are models of welding equipment of future that will be exhibited by A. O. Smith Corp., Milwaukee, at next month's welding show in Chicago. More on these space-age models next month.

. . . Stainless steel that floats has been developed by Crosley Div., Avco Mfg. Corp.

. . . Engineers are working on stress and friction problems that will be associated with supersonic jet airliners of near future. Their prediction: use of stainless-steel skins instead of aluminum.

. . . Don't be too surprised if arc welding accessory prices are increased 8-10% by mid-year. Increasing labor and material costs are chief reasons.

. . . Several welding-equipment manufacturers are reporting good quarterly earnings. Modest recovery is seen for early part of this year, with increasing sales in latter half.

. . . Purchase of S. Morgan Smith Co., York, Pa., by Allis-Chalmers Mfg. Co., Milwaukee, has been approved. Former will operate as A-C's newly created Hydraulic Div. within the Industries Group.

. . . By president proclamation, April is National Welded Products Month. WE relinquished sponsorship of the "month" to AWS, which switched from September to April to coincide with annual welding show and spring meeting.

. . . P. R. Mallory & Co., Inc., Indianapolis, has formed an international division to manage its foreign activities. It will be known as P. R. Mallory International, Inc.

. . . Steel production is seen in big comeback. Present operating rate is above 80% of this year's rated capacity, which is close to record levels of 1956.

Welding Engineer can't orbit the earth like this spaceman . . . but WE can give you the best market coverage this side of the moon in the 13 strongest welding states!

Here's a double-barreled

1–WE's April Welding Show Issue:

80% of the welding dollar is concentrated in 13 states—the very same states to which **80%** of WE's circulation is directed. The men who spend these dollars regularly read WELDING ENGINEER—and they will have a particular interest in the April Welding Show Issue.

Why? Because these industry buyers want to know, *in advance*, of the *newest* and the *best* equipment available at the Welding Show. They'll look to WELDING ENGINEER for this information—for WE has earned its reputation as *a showcase for the welding industry!*

Closing Date: March 10

AFTER DEVELOPING ALMOST 70,000 SALES LEADS IN '58

jet-assist for your welding dollar!

2–The Mid-June Fact-File Issue:

True to its name, The Fact-File is literally packed with easy-to-find, easy-to-read data that provides invaluable service for welding industry personnel. The annual industry statistics article . . . the engineering data sheets . . . the *complete* listings of manufacturers, supplies, accessories and trade names—all have tremendous year-round value for those who buy and use welding equipment.

And because it is kept handy for ready reference throughout the year, The Fact-File Issue gives *your* advertising message a 365-day selling life.

Closing Date: May 15

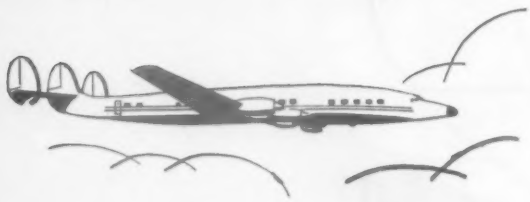
. . . WE WILL BE "SHOOTING FOR THE MOON" IN 1959!

B-1 Flux is particularly effective in removing refractory oxides such as those formed in stainless steels.

Operator fits preformed ring of BRAZE 541 prior to fluxing. This is a hose and tube assembly for an oil line.

Here operator applies gas-air torch, hand-feeding BRAZE 541 to joint.

Oil-bearing unit under induction heating.



Here's How Stainless Steel Fuel Systems Benefit From

HANDY & HARMAN SILVER BRAZING

Tube Processing Corporation, Indianapolis, Indiana, makes aircraft and missile fuel systems and, if anything has to be more failure-proof than a fuel line assembly in an airplane, you name it. The units shown here are made of 410 stainless steel tube and 321 stainless steel fittings; when they're joined, they must be joined permanently. Exhaustive tests, including X-ray, pass on each assembly before final acceptance.

Operator placing oil line (of another type) in induction heating ring.

To meet all requirements: strength, ductility, liquid and airtightness, production speed and economy, Tube Processing uses Handy & Harman's special alloy BRAZE 541 (formerly Alloy 4772) and HANDY B-1 FLUX.

Developed strictly for brazing stainless, BRAZE 541 is one of many Handy & Harman brazing alloys—both standard and special—made to do a specific job and do it better than any other metal-joining method.

Name your product and the metals it's made of, the chances are very good indeed that one of Handy & Harman's silver brazing alloys can join it better than the method you now employ. Better from every aspect: economy, speed, strength, conductivity, labor savings. Put your product in these pictures for the same benefits.

An exclusive additional benefit is Handy & Harman's application Engineering Service. This is a service that exists to show you how these benefits can best be applied to your product. We invite you to take advantage of both Handy & Harman Brazing Alloys and Engineering Service.

GET THE FACTS

Technical Bulletins T-1 and T-2 give the general characteristics of silver brazing alloys plus the compositions, melt and flow points of 32 separate alloys. Write for your copies.

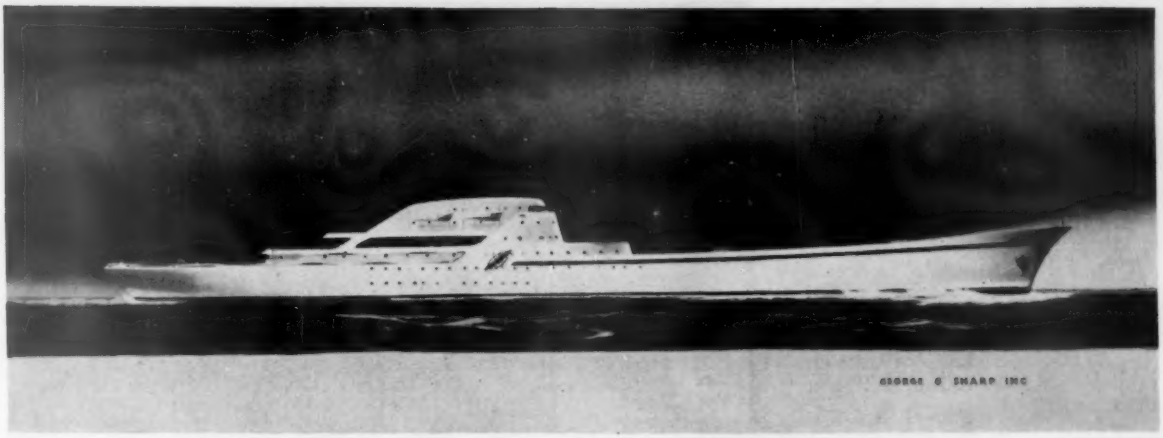
Your NO. 1 Source of Supply and Authority on Brazing Alloys

HANDY & HARMAN

General Offices: 82 Fulton St., New York 38, N. Y.

DISTRIBUTORS IN PRINCIPAL CITIES

OFFICES AND PLANTS:
ATLANTA, GA.
BRIDGEPORT, CONN.
PROVIDENCE, R. I.
CHICAGO, ILL.
CLEVELAND, OHIO
DETROIT, MICH.
LOS ANGELES, CALIF.
OAKLAND, CALIF.
TORONTO, CANADA
MONTREAL, CANADA



Welding news from New York Shipbuilding Corp.

New multiple-operator CP sets used to build first nuclear merchant ship

Twelve 1500-amp power sources capable of handling up to 360 welders

The world's first nuclear-powered commercial vessel, the NS Savannah incorporates scores of "atomic-age" developments in design and fabricating techniques. The 595½-ft. ship which will be capable of carrying 60 passengers and 9500 tons of cargo is being built by New York Shipbuilding Corporation. Scheduled for completion in 1960, it will be able to operate at speeds to 20½ knots for over three years on its initial fuel loading.

And when it came to supplying power for welding, New York Shipbuilding purchased 12 A. O. Smith Multiple Operator constant potential power sources. Hooked up in parallels of three machines each, they'll furnish power for up to 90 welders from each three-machine setup.

According to New York Shipbuilding officials, the 1500-amp machines need no maintenance . . . provide good voltage control and arc characteristics . . . are easy to set up for relocation of operators . . . and in the first six months there was no downtime.

Double duty

Many shipbuilders use A. O. Smith power sources for fabricating a ship, then install them on the ship to serve as power sources for various operating functions of the vessel itself.

New concept in multi-arc welding

CP systems like this, designed by A. O. Smith, make use of any of three new direct current, constant potential pow-

(Continued on next page)

Here are three of New York Shipbuilding's twelve A. O. Smith CP, Multiple Operator power sources hooked up in parallel. Nature of setup allows locating power sources at great distances from the work.

er sources in conjunction with series resistance grids. The systems are applicable for general welding, tack welding, stud welding, air-arc gouging, submerged arc welding or a combination of any or all of them.

These A. O. Smith units replace or augment both existing mg sets or single-operator transformer-type welding machines. In addition to shipbuilding, they offer substantial benefits for field construction, steel erection and many other types of work where steel fabricating is performed under less than normal duty cycles. The A. O. Smith Multi-Arc units are available as 500-, 750- or 1500-amp machines.

Definite advantages

A single, multiple-operator power source occupies only a fraction of the space required for a group of single-operator transformers. Yet it allows the welder to adjust his heat from his work position — no matter how distant from the MO set. It's merely a matter of locating the portable grid. Further, the A. O. Smith Multiple Operator setup cuts primary power connection and welding lead problems by at least 80%!

Other advantages include excellent welding characteristics . . . simplified, foolproof control . . . low maintenance . . . ability to power a number of stud welders or drive extremely large studs . . . weatherproofness . . . best possible voltage regulation . . . nearly perfect power factor . . . long life . . . and complete overload protection.

Low initial cost

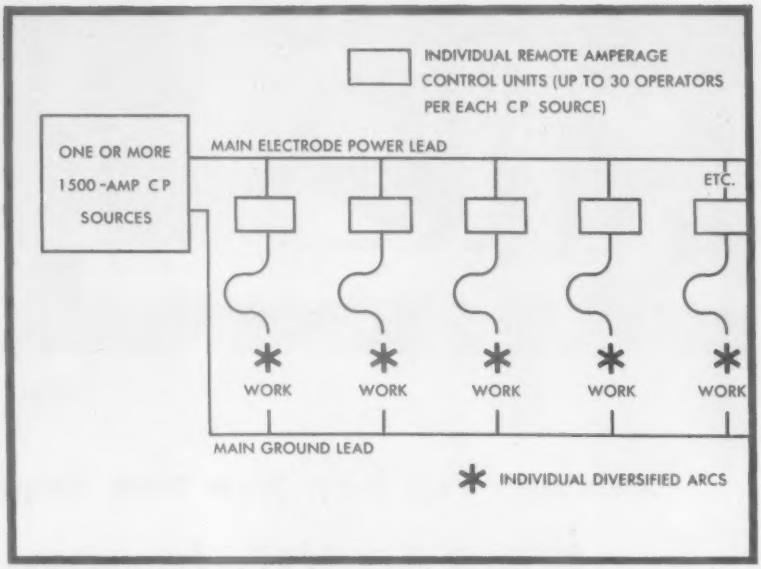
Experience has proved A. O. Smith CP Multiple Operator systems can be purchased as replacement units at less expense than the purchase and installation of a number of single-operator welding machines. And they can be wired in parallel to build up to *any* required amperage

New data available

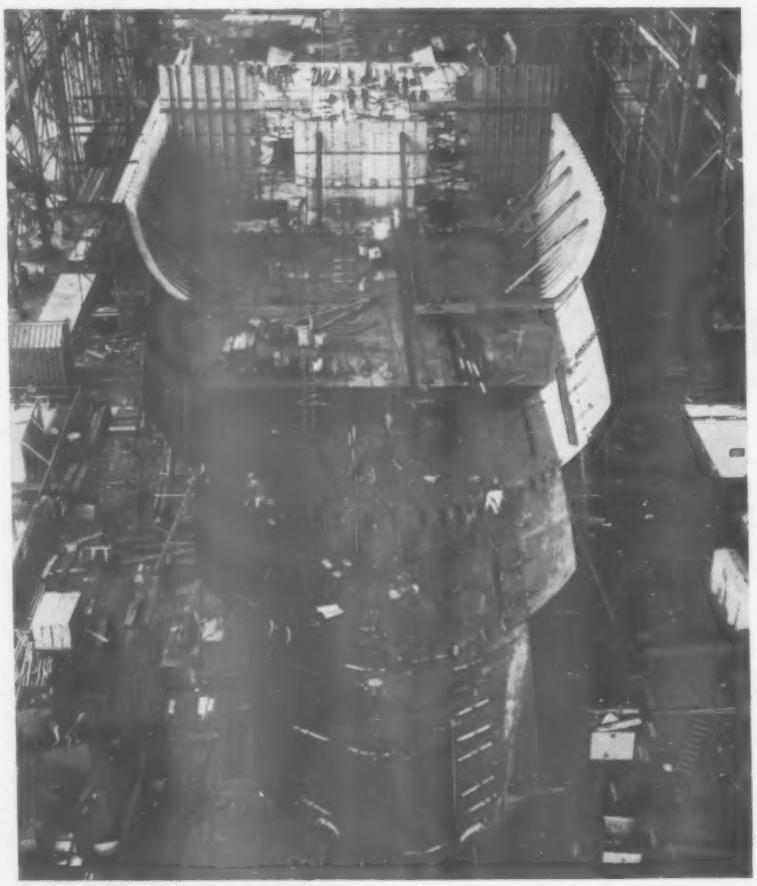
For complete information on any or all of these machines as well as the variety of series grids available, write direct to WELDING PRODUCTS DIVISION, A. O. SMITH CORPORATION, MILWAUKEE 1, WIS.

Through research ... *a better way*

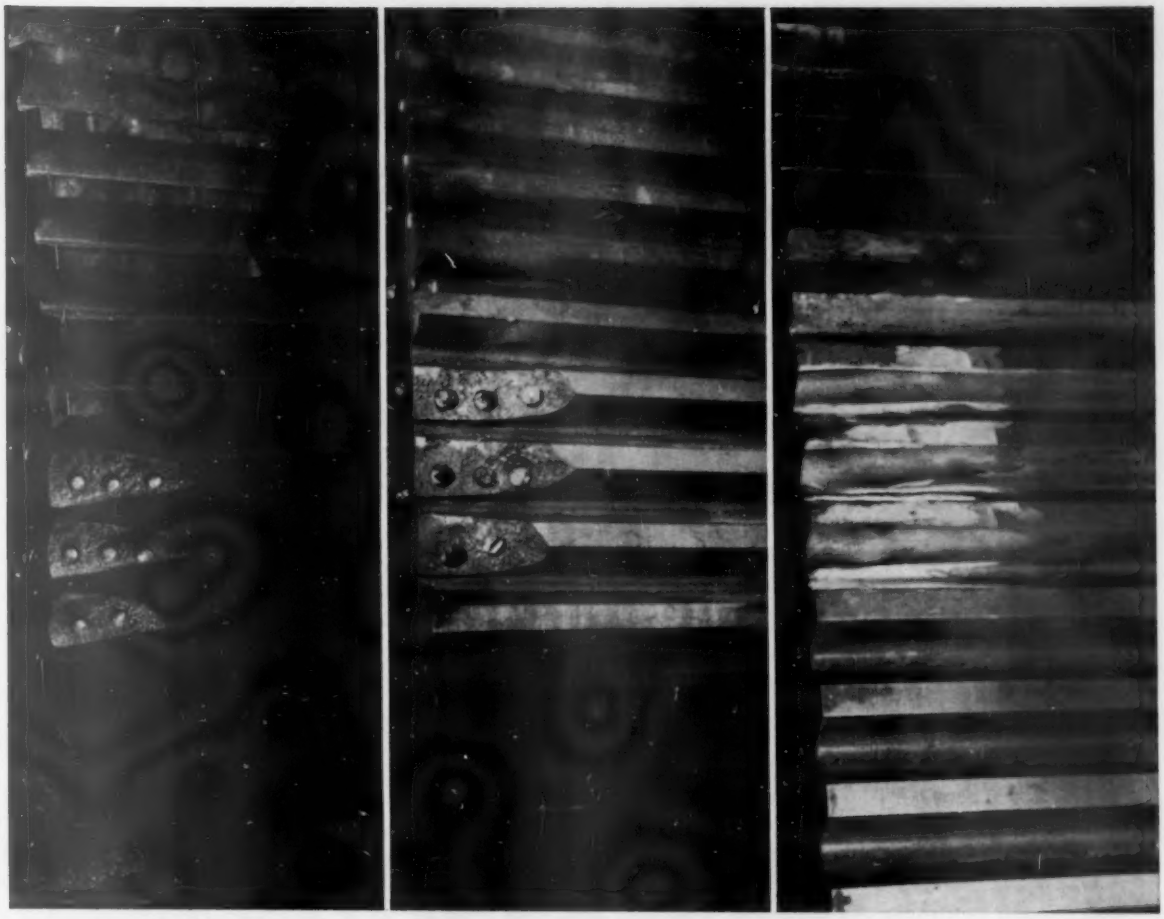
A.O.Smith
CORPORATION
WELDING PRODUCTS DIVISION
Milwaukee 1, Wisconsin
A. O. Smith INTERNATIONAL S.A., Milwaukee 1, Wis., U.S.A.



MANY ARCS FROM ONE POWER SOURCE — Schematic diagram shows why it's possible. 1500-amp. A. O. Smith power source will handle up to 30 welders . . . 750-amp unit up to 20 arcs . . . and 500-amp set up to 12 or 13 welding operations.



TAKING SHAPE—NS Savannah at partial stage of completion. Versatility of A. O. Smith Multiple Operator units make it possible for up to 30 weldors to work from one power source.



Broken teeth are drilled... **tapped and studded...** **welded with Ni-Rod "55", ground to size**

Repair with Ni-Rod "55" Electrode saves 13-ft cast iron mill gear

. . . saves $2000 new gear cost
. . . saves tough replacement job
. . . saves $8000 per day down time

Again, Ni-Rod "55"* Electrode turns a huge problem into a relatively small repair job. The 13-ft cast iron gear in the pictures above turns a power station coal pulverizing mill. One day, its pinion gear shaft broke – and stripped off three teeth before the mill could be shut down.

Replacement was impractical—meant making a gear-sized hole in a thick concrete wall, purchase of a new $2000 cast gear, and a long wait costing $8000 per day.

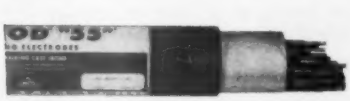
Repair was the answer– in 5 hours, weldors studded the teeth to improve the foundation; built up a Ni-Rod "55" deposit; ground the deposit to size. Cost – about $230. Today, after more than two years of service, there's no sign of failure.

Ni-Rod "55" Electrode helps you make solid repairs in cast irons – solid production welds, too. Rarely do you need preheat to get sound, strong, machinable joints.

Booklet *"Repair Cast Iron Parts Quickly and Easily"* shows how other shops have pared costs on repairs and production. Yours for the asking, from Inco.

*Registered trademark

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street New York 5, N. Y.



INCO WELDING PRODUCTS
ELECTRODES • WIRES • FLUXES

ATLAS... FIRST AGAIN!

WIDE BLADE

NOW YOU GET 18% MORE CHIPPING EFFICIENCY ALONG WITH OTHER BIG ATLAS ADVANTAGES!

Everybody benefits from an improvement like new "WIDE BLADE," the welder, the owner of the business and even Atlas because new names will be added to the thousands already on our customer list.

Why is Atlas always first with chipping tool innovations? It's simple as this—We are specialists. This is our principal business, not a side line. We are constantly looking for ways to improve weld cleaning techniques—to speed the job and do it better at less cost. Every member of the famous Atlas Line now has "WIDE BLADE," too!

Ask your welding supply dealer to show them to you.

33 MODELS THEY ALL HAVE WIDE BLADES

HERE'S WHAT 18% MORE BLADE WIDTH MEANS TO YOU

This much more weld cleaned in the same amount of time with the same amount of effort.

Sharpen less often. Tools last longer and non-productive time saved.

It's like getting a free tool every time you buy five, because the new wide blades wear longer.

ATLAS
WELDING ACCESSORIES
INCORPORATED
707 E. LEWISTON
FERNDALE 20, MICH.

Letters . . .

Letters should be addressed to: The Editor, WELDING ENGINEER, P. O. Box 28, Morton Grove, Ill. No letter will be published unless signed, but your name will be withheld if requested.

Welding at Ohio

Sir: *Columbus*

Thank you so much for the kind words in your *Welding Engineer* editorial. ("A date to remember," January, p. 29.) It is people who stand for something and are willing to stand up and be counted who help us make positive steps.

Copies will be made of your editorial and sent to my administrators. It is words from the outside, strong and vigorous, that give us an opportunity to move ahead.

We look forward to seeing you in Chicago in April.

Roy B. McCauley
Chairman
Dept. of Welding Engineering
Ohio State University

Whoops!

Sir: *Troy, O.*

On page 32 of your January issue, Part Two of "A guide to nuclear power," you refer to two nuclear power plants. I believe you will find that one of these plants is at Piqua, Ohio, rather than Piqua, Iowa. Piqua is just north of Troy.

J. H. Headapohl
Hobart Bros. Co.

Strong as a weld

Sir: *Montreal*

The Equipto Co. advertisement for steel shelving (attached), which appeared in the November, 1958, issue of *Dun's Review*, has just come to my attention. It marks a major breakthrough for the welding trade . . . I think the heading, "strong as a weld," is probably the first time I have seen a favorable comparison reference to welding.

In the past, whenever comparisons were made for strength or speed in metal joints . . . the strength of rivets, high tensile bolts or almost any other means of fastening, except welding, was used as an example.

My purpose in bringing this ad to your attention is that the heading . . . implies welding is undoubtedly, in the estimation of Equipto Co., the best means of strength fastening. They are pleased to think their method of joining is as strong.

I believe, if more manufacturers of all types of metal products would compare welding favorably . . . the entire metal working trade would accept welding as the means, or at least the primary consideration when joining any metal.

G. F. Liddell
Air Reduction Canada Ltd.

Westinghouse tube engineering...
serving the nation through imagination

DRAMATIC PROOF

that Westinghouse IGNITRONS are built to take it!

The high-peak current conduction capacities of a standard Westinghouse WL 5550 ignitron tube were recently demonstrated in hydrogen fusion experiments at a leading Western university. In this application, ignitrons successfully held off capacitor voltages of 10 kilovolts, and when fired, currents from 30 to 45 thousand amperes were discharged.

Since inventing the original ignitron tube, Westinghouse engineers have introduced a succession of significant improvements—including a water-saving ignitron with a thermostat. Next time you need an ignitron replacement, investigate the dependable, efficient ignitron series offered by the company that originated them . . . Westinghouse!

YOU CAN BE SURE...IF IT'S Westinghouse

Electronic Tube Division, Elmira, N.Y.

MESSAGE #6

Welding Wire: Cost-saving

• Production men who are conscious of *both cost and quality* agree that a top-grade weld demands the *right* welding wire. *Only* by using wire with an analysis suited to the material to be welded can consistently sound welds—free from porosity and internal cracks—be produced. Use of the right wire means fewer rejects, less waste, lower costs—plus better performance of the finished part or product.

Experienced welding men have long found PAGE a most reliable source of welding wire for all their regular and special needs. The wide range of PAGE analyses—33 of them—makes it possible to select the exact wire that produces the kind of welds that lower production costs and increase profits.

PAGE experience, talents and facilities are available to you at all times. We have been exclusive wiremaking specialists for more than half a century, and are in an ideal position to furnish our customers with the right wire for each specific need. Furthermore, we have developed a broad packaging program which saves our customers time and money by supplying wire packaged to meet any requirement.

These factors, plus PAGE'S nationwide set-up of conveniently-located distributors, backed up by nearby PAGE warehouse stocks, help make it economical and profitable for you to standardize on PAGE Welding Wire.

PAGE offers—
33 ANALYSES
...the right analysis for your welding job

There are *33 different analyses* in the PAGE line, covering the broadest range of applications: submerged arc...inert gas...tungsten or metal arc...oxy-acetylene gas welding...metal spraying.

For example—**ANALYSIS A-S-18**...The new Analysis A-S-18 welding wire was specially developed for CO_2 welding of .25 to .50 carbon steel—also for welding of free-machining, sulphur-bearing steels of the AISI-1100 series. These grades of steel have never before been satisfactorily welded by inert gas or submerged arc methods. They can be welded now as easily as low carbon steels.

As evidence of its superiority, note these physicals attained with A-S-18 on .35 carbon steel joints using CO_2 inert gas:

Tensile Strength — 75/81,000 p.s.i.
Yield Strength — 55/61,000 p.s.i. Elongation — 24%

Equal results are obtainable using a submerged arc procedure with a neutral flux. And, even higher tensiles can be expected on higher carbon steels!

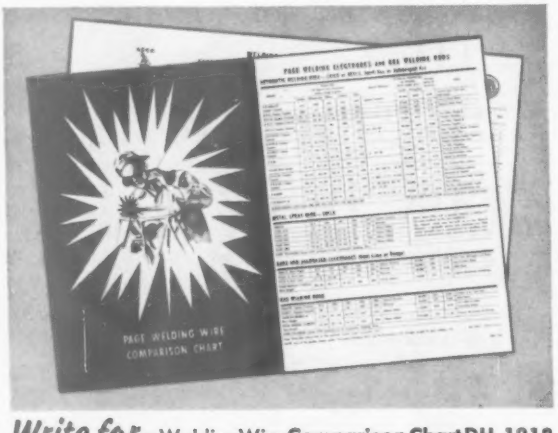
The other outstanding use for A-S-18 welding wire is in welding free-machining or sulphur-bearing steels of the AISI-1100 series. Previously, this has been a difficult, in fact, an almost impossible job. With A-S-18 the sulphur is "boiled out" by the deoxidizers in the wire; the result is a non-porous, high quality weld.

Welding men who are anxious to increase the quality of their work with these difficult grades of steel will want to test this remarkable A-S-18 welding wire under their own working conditions. They will be pleased with results!

For example—**ANALYSIS A-S-25**... Formerly known as A-S-20-G, Analysis A-S-25 is a modification of A-S-20 where the deoxidizing agents are increased to provide scavenging of all metallic oxides and other impurities, giving (with CO_2) particularly good welds in low-carbon (AISI-1006 to 1022) steel plates. Owing to the higher alloy content, it costs a little more than A-S-20, but for inert gas welding it is well worth it, as it eliminates porosity and underbead cracking.

Analysis A-S-25 is recommended for all miscellaneous CO_2 welding on mill steel work. It will give a tensile strength of approximately 75,000 p.s.i. with an elongation of 26%.

NOTE: previous advertisements in this publication have included brief descriptions of PAGE Analyses A-S-8620, A-S-6150, A-S-30, A-S-NAX-9115, A-S-65, A-S-Armco Iron, A-S-6, A-S-17, A-S-10, A-S-15 and A-S-16. Detailed information on all 33 PAGE analyses is contained in our Welding Comparison Chart DH-1218.



Write for—Welding Wire **Comparison Chart DH-1218** (*shown above*). This highly informative four-page chart lists detailed analyses of PAGE automatic welding wires, metal spray wires, bare electrodes and gas welding rods. Also shows uses and physical properties, including: tensile strength, elongation, Rockwell hardness. Chart lists virtually all competitive makes.

Write for—Submerged arc and inert gas welding wire **Folder DH-402A**...also gas welding rod **Booklet DH-1277.**

This message is for men who are vitally concerned with such welding problems as maintaining a smooth flow of production... preventing excessive rejects...and insuring trouble-free, economical, profitable operation.

and Profit Factors

PAGE offers— Packaging to meet your needs

PAGE Welding Wires are packaged in a wide variety of ways—for the most complete protection and the utmost convenience in handling, in stocking and in use. Here are some major types of PAGE packaging:

1. Paper Wrapped Coils 2. Coils in Cartons, Palletized
3. Bare Coils (packed in Leverpaks)
4. Masonite Reels 5. Payoffpaks 6. Payoffpallets
7. Gas Rods in Burlap-wrapped Bundles
8. Stainless Gas Rods in 10-lb. Tubes

For example— PAYOFFPAKS

Up to 700 lbs. of wire, without a single weld...coiled around a fiberboard cylinder within a fiberboard drum ...ready to be smoothly unreeled to the welding head for automatic or semi-automatic welding! Eliminates costly machine down-time for coil replacement. Payoffpaks come in three sizes: 20" diameter (holds 250 or 500 lbs.); 23" diameter (holds up to 700 lbs.).

Wrapped Coils—Coils in Cartons | Welding Wire in Coils | Handy Reels | Gas Rod Packing | Payoffpaks and Leverpaks | Payoffpallets

This Chart Shows How PAGE Offers The Exact Packaging You Want	Gas-shielded consumable electrode		Flux-wire for automatic or manual inert Gas Welding	Submerged Arc Welding	Straight and cut lengths Bare wire	
PACKAGING ↓ PAGE WIRE for →	Automatic Welding	Semi-Automatic Welding			Manual Electric Welding	Oxy-acetylene Welding
25-lb. or 60-lb. coils wrapped in waterproof paper, steel-strapped, single or palletized.	✔	✔	✔	✔		
25-lb. or 60-lb. coils in individual cartons, single or palletized.	✔	✔	✔	✔		
120 or 180 lb. (22"/24" i.d.) coils, paper-and-burlap wrapped, or in cartons, palletized.	✔			✔		
Special coil sizes (on application).	✔	✔	✔	✔		
25-lb. reels (spools) in carton to fit all standard machines; single or palletized.	✔	✔	✔	✔		
Leverpaks, 15" dia., 25-lb. coils (12" i.d.x2½" wide); Leverpaks, 17" dia. 50/60-lb. coils (12" i.d.x4" wide).	✔	✔	✔	✔		
Payoffpaks: 20" dia. size holds up to 500 lbs.; 23" dia. size holds up to 700 lbs.	✔	✔		✔		
Payoffpallets, holding 900-1200 lbs. of wire (⅛" to 1/16" sizes, incl.) coiled around pedestal on a wooden pallet.				✔		
Paper-and-burlap wrapped bundles, containing 50 lbs. of rods in 36" lengths.			✔			✔
Fibreboard cartons, containing 10 lbs. of rods in 36" lengths; single or boxed. 50# and over.			✔			✔
Burlap-wrapped 50-lb. bundles of bare wire electrodes in 14" and 18" lengths.			✔		✔	

Write for—**PAGE Welding Wire Packaging Chart**
This useful chart shows the many kinds of packaging of PAGE Welding Wires for each type of welding.

Now—about Delivery... PAGE offers— Availability from local stocks

• Here is a handy service that not only gets you the welding wire you need when you need it, but saves you money by making it unnecessary for you to tie up a sizeable investment in wire inventory.

You can get the exact PAGE automatic welding wire and welding rods your job requires direct from your nearby PAGE Distributor. Located at many points from coast to coast, PAGE distributors carry sizeable stocks for your convenience—and they are backed up by PAGE Warehouses at the strategic locations shown below. Close cooperation between PAGE distributors, PAGE warehouses and the PAGE mill is your guarantee of prompt, intelligent, individual service on your specific needs.

ACCO

Page Steel and Wire Division
AMERICAN CHAIN & CABLE

Monessen, Pa.*, Atlanta, Chicago*, Denver*, Detroit, Houston* Los Angeles*, New York, Philadelphia*, Portland, Ore. San Francisco*, Bridgeport, Conn.

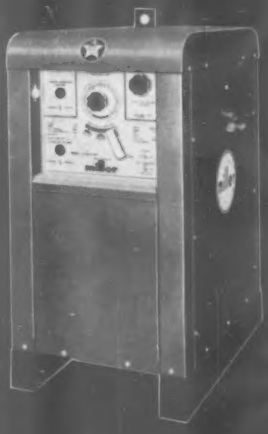
*Indicates PAGE warehouse stocks

ACCO for Better Values

SR . . . the dc rectifier type welder with new completely sealed semimetallic rectifier, new transformer and new weld stabilized circuit. Result is easiest arc starting ever; maximum arc stability; sounder, denser welds; current that handles all electrodes in all positions! Four models, 200 to 600 amps.

SRH . . . the same revolutionary improvements that set the Gold Star SR above and beyond the performance standards ever before achieved by a dc rectifier type welder. Designed primarily for compactness, the SRH is only 30¼" high — is ideally suited for stacking or paralleling in minimum space. Three models, 200 to 400 amps.

The miller GOLD STAR ALL STAR LINE



300 . . . combination ac dc welder design comes of age with this new Miller model. Features: new magnetic amplifier circuit; improved wave form; new arc starting control; three electrically controlled current ranges for finest adjustment; instant change-over from ac to dc; built-in high frequency. An entirely fresh concept for inert gas and metallic welding. Four basic models with kits available to convert to seven different types of welders.

300-M . . . an ac welder for inert gas and metallic arc processes. Combines unequalled welding characteristics with Miller's unique electric control circuit which permits precise slow or fast start. Features: built-in high frequency, primary contactor and ½ KVA control transformer. Offered in three basic models of from 200 to 400 amperes with optional water and gas controls available.

Complete particulars on any of the above welders will be sent promptly.

miller ELECTRIC MANUFACTURING COMPANY, INC., APPLETON, WISCONSIN

Distributed in Canada by Canadian Liquid Air Co., Ltd., Montreal

EXPORT OFFICE: 250 West 57th St., New York 19, N. Y.

BETWEEN PASSES

good judgment

Our nomination for a special award for promoting welding goes to Shearer Machine Co., 219 Whitehall St., SW, Atlanta, Ga. Earlier this year, the firm ran a display ad in the Atlanta *Journal and Constitution* which contained this statement: "Good judgment . . . can save you dollars when you decide to weld rather than discard that worn or broken part . . ." The Shearer firm has rendered welding service to Atlanta industry for three generations.

April is National Welded Products Month, and the Shearer advertisement should set a good example. Remember to do your part.

the end . . .

The *S.S. Patrick Henry*, the first of more than 2,700 welded Liberty ships which helped win World War II, was recently towed to an ignominious end—the scrap pile. Built at the wartime Bethlehem-Fairfield shipyard, the ship was hauled out of the water to be scrapped on the very ways on which it (how can you call a ship named the *Patrick Henry* a *she?*) was built—now the Bethlehem Patapsco scrap yard in Baltimore. The ship's keel was laid April 30, 1941. It was launched Sept. 27, 1941. Its varied war service included the "suicide run" to Murmansk and Archangel.

short supply

Despite still-critical demands for engineering talent, enrollment in American engineering schools is on the decline—for the first time in seven years. The American Society for Engineering Education reports that 153 accredited American engineering colleges had 2.9% less students in the fall of 1958 than in the same term of the previous year. The freshman class last fall was 11.6% smaller than in 1957.

rescue

The top news story in the Chicago metropolitan area Jan. 29-30 was the dramatic rescue of a diver who was trapped more than six hours in icy water 179 ft below the earth's surface. The diver, Frank Hefling, suffered little injury, but his ordeal deservedly was the headline story on Chicago's front pages. Hefling is not unknown to readers of WELDING ENGINEER . . . at least not to those who were readers in 1953.

In the October edition of that year, an article entitled "He cuts up scrap on the river bottom" graphically described a cutting job at the bottom of the Calumet River. The diver: Frank Hefling of Underwater Salvage Co., Chicago.

On this past Jan. 29, Hefling was sent down to check on a leak in a water tunnel control shaft on the city's south side. The supposedly watertight bypass gate was partially opened, and when Hefling descended, his airline snarled on this gate. When his suit tore at the wrist, water seeped into the diving outfit until all but his head was immersed in water. Pressure from his air hose prevented the water from rising higher, thus saving his life.

Aiding his rescuers was a friend, Edward Devine. A veteran diver himself, Devine is also associated with the welding industry—he is a welding instructor at Greer Shop Training School, Chicago.

disaster at sea

It is always our practice to boost welding . . . still, we don't like to do it as an aftermath to a tragedy in which is involved a competitive fabrication process. Nevertheless, it is in the public interest (and certainly of interest to our industry) to know some of the background facts about the *Hans-Hedtoft*—the Danish motorship that was lost at sea early last month. The craft hit an iceberg off the coast of Greenland and sank, with the loss of 95 lives.

This modern ship, on its maiden voyage, had a double steel bottom, seven watertight compartments, and was equipped to pass through icy waters. One aspect of construction, however, worried some Danish experts—it was riveted. One shipbuilder said the *Hans Hedtoft* should have been welded, because the riveted plates could not afford sufficient resistance to pressure from ice.

the Titan

The recent successful launching of the intercontinental ballistic missile Titan again reminds us of welding's importance to the welfare of this country. The Titan is the first ICBM with an aluminum exterior. Walls of the propellant tanks also form this outer skin (which probably accounts for the aluminum's ability to withstand higher than normal temperatures), thus become an integral part of the airframe. Extruded by Alcoa, the metal is shipped to Martin Co.'s Denver Division, where it is stretch formed, milled and welded.

welding show

Next month we hope to see you at the annual AWS welding show. This year the spring meeting and exhibition come to us, as they will be held in Chicago the week of April 5. The Hotel Sherman is headquarters hotel for the meeting which will run April 6 through 10, while the International Amphitheatre will house the show from April 7 through 9. All of our readers are cordially invited to visit us in our booth—No. 915.

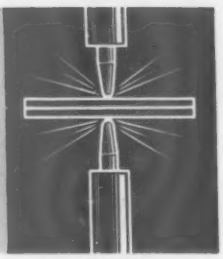
"The boss offered me a partnership today, but I'm holding out for a 2-cent raise."

P.R. MALLORY & CO. Inc.

MALLORY MEMOS

NEWS AND TIPS ON RESISTANCE WELDING

P. R. Mallory & Co. Inc., Indianapolis 6, Indiana

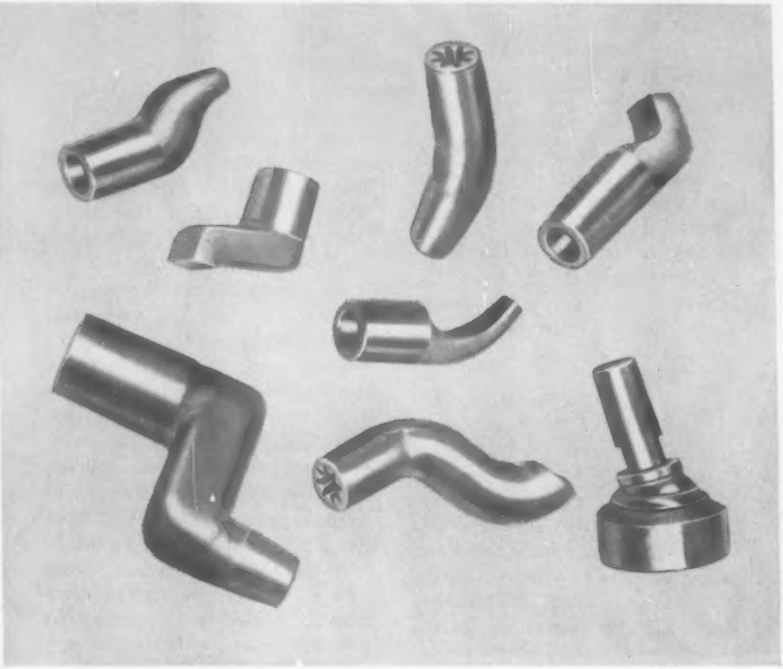


WELDING HINTS

To make it easy to remove electrodes from the holder, give the tapered end a thin wipe of light grease before you insert it in the holder. This prevents binding, helps the electrode pop out with the first tap of the hammer when you make a change in set-up.

Don't use white lead or similar compounds to seal a leaking taper. This insulates the electrode in the holder and leads to arcing and damage. If you've got a chronic leak, better ream out the holder and switch to new electrodes. (Mallory tips and holders, by the way, are precision-machined.)

Send for this useful chart of "Do's and Don'ts for resistance welding"—full of valuable ideas—ready to hang on the wall in your shop.



Need Special Electrodes? Mallory STANDARDS May Do the Job!

Here's a good way to save yourself the extra cost and delivery time for resistance welding electrodes for "special" jobs. Just check through the more than 200 types that Mallory distributors carry as standard, shelf-stock items. You'll probably find exactly the tips you need—at attractive cost, and delivered immediately.

It's a varied line; includes straight electrodes with pointed, dome, flat and other tip shapes, in several Mallory alloys to give you the combination of conductivity, hardness and strength you need. Also socket type electrodes, a broad selection of irregular shapes, threaded electrodes, and Elkonite® faced types.

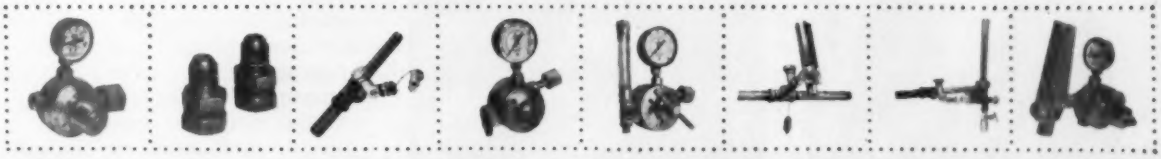
It's a performance-built line, made to give you more welds per dollar through the use of Mallory alloys and production skills. Many types are available with the exclusive Mallory fluted cooling hole that gives extra long life.

Order from your nearby Mallory welding distributor. He'll be glad to give you a copy of our catalog which lists the complete electrode line.

WITH AIRCO'S

COMPLETE LINE OF CONTROL DEVICES FOR

ARGON, HELIUM, CO_2, AIRCOMATIC "75"*



Single-Stage Fixed Pressure Regulator Low in cost . . . sturdy. No flow rate tampering.

Flow Adapter— Exact gas flow needed. Prevents tampering . . . saves.

"B" Station Valve for Flow Adapter —reliable shutoff. Compact, sturdy, versatile.

Fixed Pressure Two-Stage Regulator—exact gas flow needed. For two operations.

Two-Stage Flowmeter Regulator— complete flow coverage for virtually all uses.

Station Flowmeter —complete coverage. Low cost . . . extremely rugged.

Dual Range Flowmeter—complete coverage. Versatile, excellent readability.

Single-Stage Flowmeter Regulator— Rugged, compact. No heater required for CO_2.

*75% Helium, 25% Argon

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Lincoln

WELDYNAMICS

NEWS ABOUT ARC WELDING AT WORK CUTTING COSTS

CLARK CUTS DOWNTIME, REDUCES MATERIAL COSTS 25%

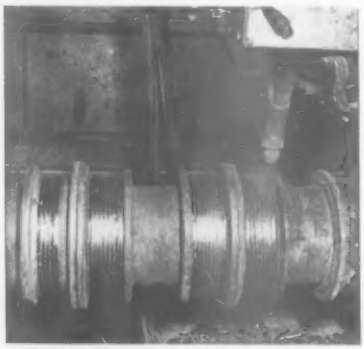
The Clark Machine and Welding Company, Inc., of Baltimore, Maryland, has a department which specializes in rebuilding industrial and construction equipment. They've grown in 25 years from a 4-man shop to the largest maintenance shop in Maryland—employing about 75 people. During that time they've tried just about every automatic hardsurfacing wire and flux available, and have had troubles ranging from high material costs to excessive downtime in the shop.

Rebuilding tractor rollers in the Clark shop. The fixture was designed and fabricated by Clark.

A. L. Ballard, Clark's welding foreman, "We've eliminated many production problems, cut costs and improved the quality of our work."

Work stoppages were caused when some welding wire would jam in the feed rolls of the automatic welder or the wire would stick. This, of course, not only caused the machine to be stopped, but affected the quality of the deposit as well.

Other granular fluxes with alloy wire were tried. Performance was better, but the alloy wire proved too expensive, according to Phillip Killen, Vice President and General Manager of the firm.



Al Ballard, the company's automatic welding foreman, has found that Lincoln agglomerated fluxes give him the most reliable performance. The fluxes not only cost 25% less than the most similar competing product, but they contain the alloying elements making it possible to use less expensive mild steel wire.

Mr. Killen states that the use of agglomerated fluxes and Lincoln automatic welding equipment have given his shop a definite advantage with consistently top quality work at a substantial saving.

HARDSURFACING INFORMATION MADE AVAILABLE

A series of How-to-do-it bulletins on Automatic Submerged Arc hardsurfacing are being published by The Lincoln Electric Company.

A basic bulletin, number 3200.1 on Automatic Submerged Arc hardsurfacing starts the series.

Specific information on hardsurfacing and rebuilding is presently available on the following items: tractor rollers, tractor idlers, mine car wheels, scraper blades, steel mill rolls, crusher rolls (with automatic), crusher rolls (with semi-automatic), Raymond bowl rolls, Raymond bowl rings, tractor treads and cement mill equipment.

Copies of these bulletins may be obtained by writing on company letterhead to:

The LINCOLN ELECTRIC CO.
Dept. 1752, Cleveland 17, Ohio
The World's Largest Manufacturer of Arc Welding Equipment

MARCH, 1959

Welding Engineer

ESTABLISHED 1916

A month for welding

NEXT MONTH—April, 1959—will be National Welded Products Month. It has been so proclaimed by the President of the United States. But even a presidential proclamation won't insure its success. This effort will be successful only if it gets the unqualified support of all of us in the welding industry.

You will recall, only a few short months ago, WELDING ENGINEER's campaign to "Remember September—National Welded Products Month." This activity on our part prompted proclamations by mayors and governors in many cities and states. It helped make thousands of persons conscious of welding—and of its importance in their daily lives.

This year, April will become National Welded Products Month to coincide with the American Welding Society's annual meeting and welding exposition. Because of these important events, WELDING ENGINEER has relinquished sponsorship of National Welded Products Month in favor of a program sponsored by AWS.

All of us know, however, that actual sponsorship rests in the hands of those who work with welding. It is at the individual level that the story of welding can best be told. So let's tell it!

Through the years we've mentioned here that welding is responsible for streamlined ships and planes, and for better, cheaper automobiles . . . for more sanitary sinks and more rugged appliances . . . for glass-to-steel joints that give us highly efficient TV tubes . . . for costume jewelry and for our wedding rings, as well.

This is the story you can tell the world. Tell it to your friends as you visit with them. Tell it to the cab driver you pass the time of day with. Tell it to your fellow-commuters.

It's the story of the century, and it deserves to be told.

NATIONAL WELDED PRODUCTS MONTH
APRIL

You get VICTOR QUALITY thru-out this package

We've assembled the Super-Range unit for the man who wants a first-class, complete outfit, ready to handle a full range of shop work—welding, cutting, heating, brazing, soldering. Everything needed to go right to work is included.

Every item listed is Victor's standard, top-quality apparatus . . . and you get the complete outfit for only $99.00. Order from your Victor dealer now.

Profitable dealerships open in a few areas; inquire now.

Two Victor single-stage safety regulators,
Model SR 210-970 Acetylene
Model SR 200-967 Oxygen

Victor welding torch Model 100

Victor cutting attachment Model 550-100

Victor welding torch nozzles, Type 13, sizes 0, 2, and 4; (welds to ¼″)*

Victor cutting tip, Type 5-101, size 1; (cuts to 1″)*

12½ ft. dual welding hose, 3/16″ diameter

Spark lighter, goggles, and wrench

*By adding Victor nozzles and tips of larger or smaller capacities to Super-Range unit, you can greatly increase the working range.

VICTOR for welding

VICTOR EQUIPMENT COMPANY

Mfrs. of welding & cutting equipment; high pressure and large volume gas regulators; hardfacing rods, blasting nozzles; cobalt & tungsten castings; straightline and shape cutting machines. 54

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J. C. Menzies & Co., wholly owned subsidiary

AT McCHORD AFB:

Oxyacetylene torches straighten fire-warped steel

Part II . . . the completion of repairs, the laboratory reports, and final cost details.

WHILE the flame-straightening crew continued its work on arch trusses in fire-wracked hangars 1 and 2 at McChord Air Force Base, another group of structural ironworkers tackled the repair of one joint which had failed.

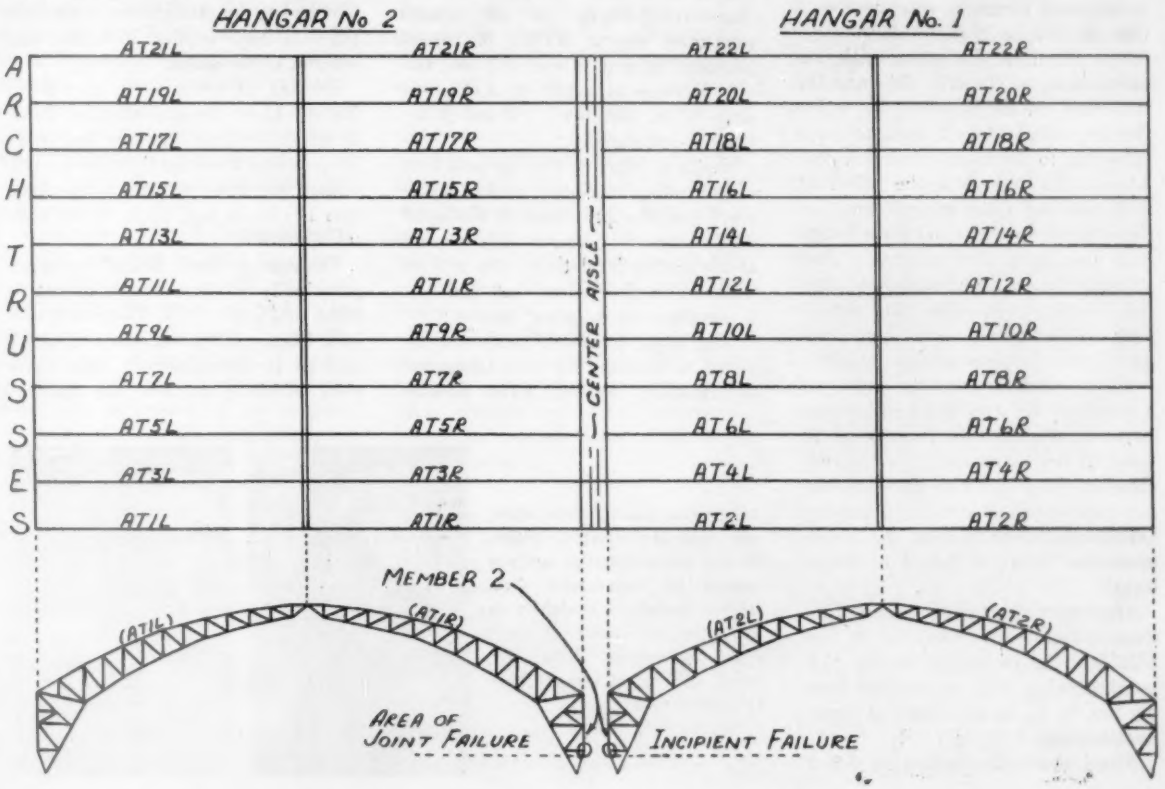
As mentioned in Part I of this article, rivets holding members of hangar 2's door truss sheared, allowing the truss to fall onto the main doors. This fall was not a lengthy one; actually the joint separation was 5¼ in. Also noted by the damage survey was an incipient failure in the corresponding joint of a truss member in hangar 1. There was a ¼-in. slip in this joint.

The joint which failed was handled in this manner: (*1*) shores and jacks were employed to lift the truss off the door; (*2*) truss members were aligned and the rivet holes were reamed; (*3*) failed rivets were replaced with ⅞-in. high-tensile bolts. Additional strength was given to the joint when a ⅝-in.-thick plate was fillet welded to both flanges of the truss member that had fallen, and to the gusset plate with a single-bevel butt weld.

That truss joint in hangar 1 which showed incipient failure was repaired by the addition of side plates in the same manner in which they were applied to the failed joint.

This discovery of one joint failure —and of one that almost failed—led those in charge of the McChord proj-

SKETCH shows position and number of arch trusses in hangars 1 and 2 at McChord AFB. Also marked are areas of joint failure and incipient failure. All trusses are 10-in. wide-flange sections of varying weights.



Laboratory reports on steel specimens

Test piece	Cut from	Condition	Yield point (psi)	Ultimate strength (psi)	Elongation (% in 8 in.)
1	3½x2½x¼"	FD*	37,300	61,300	39% (in 2")
2	4x3½x⅜"	FD FS**	38,527	59,932	14.1
3	4x3½x⅜"	FD FS**	40,275	59,725	18.1
4	4x3½x⅜"	FD FS**	38,801	60,487	20.4
5	4x3½x⅜"	FD FS**	43,620	60,060	17.5
6	4x3½x⅜"	FD FS**	37,730	60,320	18.5
7	4x3½x⅜"	FD FS**	47,010	62,690	15.0
Allowable for ASTM-A7 steel:			33,000 min.	60,000 min.	24% min.

*FD *indicates fire damaged*
**FS *indicates flame-straightened*

TABLE I indicates, on the basis of seven test samples, that steel in the McChord hangars suffered no appreciable loss of yield strength. Ultimate tensile strength and ductility was obviously decreased in some instances, but still complies with ASTM-A7 specification.

ect to investigate similar joints in other trusses. As part of this effort, the searchers sheared the heads from one rivet in each of five truss joints and backed the rivets out.

They noted no slip in any of these joints, and the appearance of rivets and rivet holes was normal. Nevertheless, these rivets were sent out for metallurgical examination.

The most badly distorted beam in all truss members was member 2 (see sketch), a 10-in., 33-lb/ft wide-flange beam in the center aisle between hangars. In this aisle was the two-story frame building in which the fire originated. It was an area subjected to the most severe fire conditions. To determine the effect of both fire and flame-straightening on these members, the panel point length was measured before and after straightening in some instances, after the flame application in others. Lengths computed were then compared with original design lengths.

Final measurements show that, as a result of fire and flame-straightening, member 2 was lengthened in three of the 22 trusses . . . was unchanged in length in three trusses . . . and was shortened in 16 trusses. Lengthening was minor: the maximum was ⅝ in., or 0.40% of design length.

Maximum shortening occurred in truss AT10L, and was 3½ in., or 2.24% of design length. Of this 3½-in. shortening, 2¼ in. resulted from the fire, ¾ in. as the result of flame-straightening.

There were nine trusses on which measurements were obtained before and after flame-straightening to determine relative amount of shortening resulting from both factors. This work indicated that almost all shortening was due to the fire; that due to flame-straightening amounted to no more than ⅜ in.—except for truss AT10L, where it was ¾ in.

Members 1 and 3 increased in length as a result of both fire and flame-straightening in all trusses measured except AT8L. Maximum increase in length was 1¾ in., and the decrease in length in AT8L was only ¼ in. Members 1, 2 and 3 are tension members.

Smith & Murray, the Tacoma firm of consulting engineers which supervised overall repair work at McChord AFB, notes that in the aisle section at the gutter level there was a 5-in. increase in the spread between No. 3 members on adjacent trusses.

The firm, however, made no attempt to account for this measured deformation, stating: "The factors involved are so numerous and indeterminate that any discussion of their causes would be conjecture. These factors do, however, give assurance that geometrical truss patterns remained essentially unchanged, and that truss strength, as a whole, has been unaffected."

Member 18 in truss AT21L, a 10-in., 77-lb/ft WF beam, had a reverse curvature in two planes. Since this is a compression member, it was necessary to relieve stresses before straightening. This was done by picking up truss load with a timber strut placed between the joint at the top of member 17 and the adjacent wall column footing. Jacks were used on top of the four-angle latticed columns adjacent to the truss on the hangar's rear wall.

Horizontal roof bracing in the McChord hangars, a large part of which had to be flame-straightened, consists of single-angle members, 3 in. by 2½ in. by 5/16 in. Each is connected to bracing trusses and jack beams at the level of bottom flanges of the channel purlins.

Distortion of the members, which took the form of sagging or bowing, was evenly distributed over the roof area. Of the 656 bracing members, 370 had to be straightened—and the job was done without difficulty, and without replacement.

Purlins, of which there are 690 in the combined hangar structure, suffered such slight damage that only 36 required flame-straightening. Tolerance for these structural members was 1½ in. in sag, ½ in. in horizontal distortion.

Damage to jack beams occurred principally in those beams closest to front and rear walls. There are 240 jack beams in the structure, and 32 had to be straightened. Tolerances were identical to those for purlins,

AFTER fire, framing girder along rear wall of hangar 2 (right) showed severe distortion and was marked for replacement. Contractor elected to straighten it, and after application of torch and supplemental forces (far right), girder was brought back to pre-fire shape.

and all roofing had to be removed before straightening was attempted.

Bracing trusses, struts and knee braces are single- and double-angle members. Compared to the wide-flange truss members, these are relatively thin pieces. Consequently, they suffered more extensive fire damage. Of 2,712 members, 524 were flame-straightened and 32 had to be replaced. Replacement occurred whenever, in the contractor's judgment, necessary straightening time would be too costly.

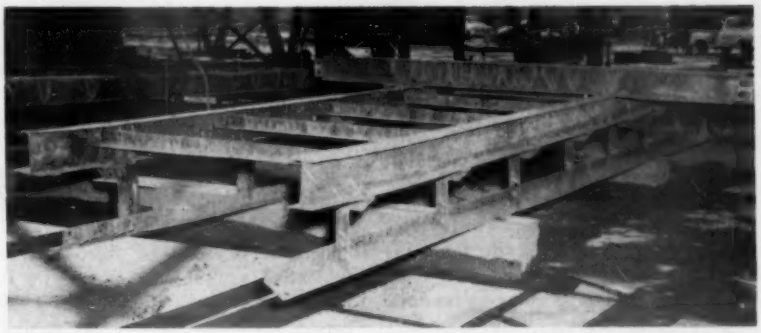
Buckling of many bracing truss members was caused by unequal movements of adjacent truss joints to which the bracing members were connected. These movements caused an increase or decrease in the length between bracing truss panel points and a resultant buckling or stretching of the members.

Straightening of these members was done (*1*) by shortening the member with a heat application if deformation was comparatively slight, or (*2*) by loosening one end connection of the member and arc welding that end to its gusset plate after the member was flame-straightened.

Tail-gate doors were warped out of plane, but they were flame-straightened without difficulty. After straightening, counterweights were attached and the doors were operated by a truck-mounted winch. From the point of view of cost, this operation was particularly valuable, for the doors originally were scheduled for replacement.

Wall girts in the McChord hangars are 8-in. channel sections. Fire damage to them was quite extensive, and 316 out of 685 members had to be straightened or replaced. Since the damage survey had listed damaged members only in approximate numbers, the straightening or replacement of girts was bid on a unit-price basis.

Roy T. Earley Co., the contractor on this job, proposed that a number of girts scheduled for replacement could be flame-straightened at varying unit prices, each of which was higher than the contract unit price for straightening—but lower than unit price for replacement. Results of this proposal are presented later in this article.



FIRE warped all steel members of gutter framing in McChord hangars. Panel section at right, removed for straightening, exhibits typical distortion. After flame application (below) panel was replaced and another taken down for straightening. Note V-shaped heat patterns on finished panel.

Rear walls in hangars 1 and 2 consist of four-angle double latticed columns varying in height from 60 to 90 ft. Three sets of horizontal girts on each column are comprised of two latticed, 8-in. channels. There are a total of 98 members in the rear walls, of which 3 columns and nine struts had to be flame-straightened.

One column in hangar 2 was severely damaged by the fire, and was marked for replacement. The contractor, however, chose to flame-straighten it. This was done *under load,* using supplementary forces, and was the only column which presented any difficulties to torch operators.

All gutter framing was damaged and needed straightening. This framing was removed in sections (complete dismantling wasn't required), given the needed flame application, and replaced.

Main door repairs consisted mainly in replacement of weather stripping and track wipers. Additionally, however, one door which had jumped the track rail had to be replaced; all trucks had to be inspected and cleaned; a cracked wheel had to be repaired by arc welding, and the tops of the two center leaves (there are 24 in all) in hangar 2's doors had to be straightened. The front plates at the top of these doors had been damaged by the collapse of truss AT1R.

The canopy over main doors is suspended from the door trusses (AT1R and -L, and AT2R and -L) by vertical members which are 8-in. WF sections. Canopy framing is cantilevered out from the suspenders and carries the guide tie for the guide rollers on top of the main doors.

When the joint in truss AT1R failed, and the truss started to fall, it came to rest on the center door leaf with the guide tee on top of the door. Weight of the truss and its supported load was imposed on the door, causing upward reaction on the cantilevered canopy frame. Compressive stress produced in the upper sloping member of the canopy frame buckled flanges and webs of the 8-in. WF hangers, and forced the canopy out of line both vertically and horizontally.

Operational sequence in repairing these conditions was:

1. The arch truss was jacked-up to take the load off the main door, and the failed joint of truss AT1R was closed and made structurally sound.

2. Canopy framing was shored-up from the hangar apron with timber

MOST steel elements in structure of McChord hangars have been flame-straightened in this photo taken almost six months after work began, and roofing material is being replaced. A total of 8,073 man-hours (including supervision) was devoted to flame-straightening during the entire job.

struts and jacks, and the framing was then cut loose from its hangers.

3. Hangers were flame-straightened.

4. Canopy framing was jacked to a proper level to afford original clearance between top of doors and frame—then reconnected to hangers by arc welding in some instances, through use of high-tensile bolts in others.

5. Outer edge of canopy framing was aligned vertically by applying torch heat to shorten the upper diagonal member of the canopy frame.

Flame-straightening of fire-damaged steel obviously cannot be justified if steel strength is reduced as a result of fire damage or flame-straightening, or both. But since there was practically no published information available on the subject, the engineering firm of Smith & Murray wisely decided to send seven specimens to two different agencies for metallurgical examination.

These specimens were taken from members that had been severely fire damaged, and represented both straightened and unstraightened pieces. Four samples went to the Seattle branch of the Pittsburgh Testing Laboratory; the remaining three went to Bethlehem Pacific Coast Steel Co.'s metallurgical lab in Seattle.

The five rivets pulled for examination and mentioned earlier in this article were sent to the Fritz Laboratory at Lehigh University for a thorough examination.

Results of the tests on structural members is reported in Table I. The report on the rivets, obtained through the cooperation of the American Institute of Steel Construction, is presented below, but only as it relates to those rivets which failed.

"*AT2L:* A good, sound rivet before the fire; during the fire it appears to have been heavily loaded, as evidenced by marked deformation of the shank. In fact, the ruptured surface might have been a shear failure; however, this surface is completely altered by the great amount of cold working it received when being backed out . . .

"*AT1R:* Failure of this rivet is typical of a double shear failure. It is difficult to say whether this happened sometime before or during the fire because the heavy rust all over the rivet might indicate . . . a long-time condition of ordinary atmospheric humidity or a shorter time under the influence of a highly corrosive fire-fighting chemical."

The report from which the above comments were excerpted was signed by J. L. Rumpf, director of research at Lehigh University.

Total man-hours spent in flame-straightening structural steel in hangars 1 and 2 at McChord AFB amount to 8,073 (including supervision). The cost per hour for this work (which covers tools, equipment, oxygen and acetylene, taxes, bond, overhead and profit in addition to workers' and supervisors' wages) was reckoned at $11.96—or a total of $96,553.08 for the entire job.

Contractor R. T. Earley Co.'s original bid of $166,848 for all flame-straightening was actually surpassed before the job ended—but only because the firm exercised its option to straighten many members that the damage survey had marked for replacement. Such work, as noted earlier in this article, was contracted for on the basis of a unit-price bid that was somewhat above the cost of scheduled flame-straightening, but well below the unit price of replacement.

As an example of how this decision profited both the contractor and the Air Force, consider the work done on 57 of 69 girts selected for replacement. These were 8-in. channel girts, and contract bid price for straightening this type was $30. Cost of replacement would have been $80.

After making unit-price bids ranging from $36 to $72 each on the severely damaged girts, the contractor succeeded in straightening 57 of them at an average cost of $49.26 each. This was $30.74 per girt under the unit-price bid for replacement—a savings of $1,752.18!

And this was not an isolated example of savings: instead of an estimated 1½ tons of structural steel to replace tailgate doors, *no* steel was actually needed; instead of 61.9 tons of structural steel for miscellaneous replacements, the Air Force had to buy only 8.8 tons; instead of purchasing 150 replacement girts, they ultimately needed only 12.

By every standard—time, cost, quality, safety—the flame-straightening process, as it was applied at McChord AFB, proved its worth as a top-flight steel repair method.

Credit for success of the McChord flame-straightening job goes—not only to Smith & Murray and Contractor R. T. Earley Co.—but also to these men under whose supervision repair work was performed:

On the flame-straightening crew . . . Richard E. and Fred Holt, sons of supervisor Joseph Holt, and Richard Newell, who represented Smith & Murray.

On the Air Force team . . . Lt. Col. C. S. Johnstone (now retired), installations engineer at McChord; Lee Bentley, principal engineer, and Paul Myers, project engineer.

WELDOR joins aluminum side plating to frames with Mig gun. Note the saw-toothed appearance of frames where cut to receive plates. Firm's name for hull design is "polyhedral."

Mig welding fabricates a unique hull bottom

A UNIQUELY DESIGNED, all-welded aluminum boat, whose high speed performance could revolutionize water transportation, has been unveiled by Higgins, Inc., of New Orleans.

The unusual hull form of the 52-ft craft, fabricated with Alcoa aluminum alloy 5456, makes possible riding qualities and maneuverability previously unobtainable in high-speed vessels except in calm water.

The new boat was developed for transporting personnel and performing patrol, rescue and other services where speed and good sea performance are vital. Speeds up to 40 mph can now be easily maintained—even in 3½-ft waves.

Approximately 10 tons of aluminum sheet and plate, ranging from 3/16- to 1-in. thick, were used in the prototype hull. Frames were formed in conventional shape, with a series of steps cut into the outside edge of each to give a saw-toothed appearance. Cold-formed plate was then fitted in the corresponding notches and Mig (metal inert-gas) welded.

The resulting bottom, with its multiple lengthwise steps, greatly reduces wave impact. The form deflects water away from the hull and provides progressive cushioning for the bow's downward movement.

Edge preparation consisted of a 30-deg bevel for one-half the plate thickness to permit an average ⅛-in. root face. All weld areas were then cleaned by air-blasting.

Components and sub-assemblies on the basic hull were joined by Mig welding, while fabrication and assembly of the light-gage deck house employed Tig welding. Wire diameter used in all Mig operations was 1/16 in. For Tig welding, 3/32 and ⅛-in. wire was generally used.

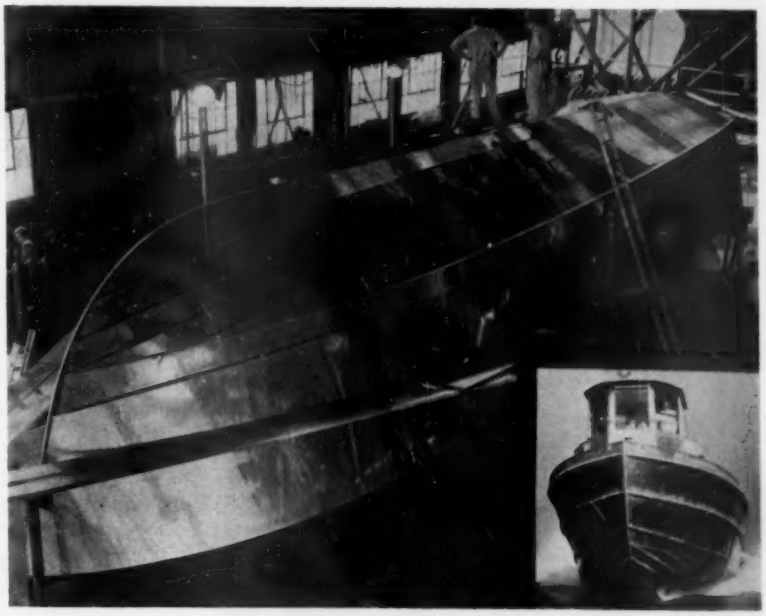
Power sources for both processes were 600-amp transformers. Current setting for Mig was 250 amp, 40 volts; for Tig, 160 amp, 55 volts.

Welding speed was approximately 15 ipm, with a wire feed rate of 18 ipm. Single passes were generally sufficient on the hull interior.

All weld seams were back-chipped, and a finish pass was made from the hull exterior. Amount of weld deposit averaged 88% of the total 600 lb of welding wire used.

Exterior welds were ground smooth and minutely examined for defects. Very little porosity was discovered, and all porous welds were chipped to solid metal and rewelded.

Argon was used for shielding at an average rate of 40 cu ft per hour. The entire job consummed 40 cylinders, each holding 2,600 cu ft.



FINISHED hull shows unique design which company claims will give greater stability and maneuverablity at high speeds even in rough waters.

FENDER repairs are accomplished with soft solder and oxyacetylene torch.

Photos courtesy of Anchor Metal

Filler metals for joining

by **Orville T. Barnett***

FROM THE CRUDE UTENSILES and priceless jewelry of antiquity to the powerful autos and delicate electronic circuits of today, soft solders have experienced expanding use.

The majority of all soft solders are tin-lead compositions (see table 1) which may be slightly modified with other metals. Recognized types include tin-lead-antimony, lead-silver, tin-zinc, cadmium-silver, cadmium-zinc, tin-antimony, tin-silver, zinc-aluminum and tin-indium.

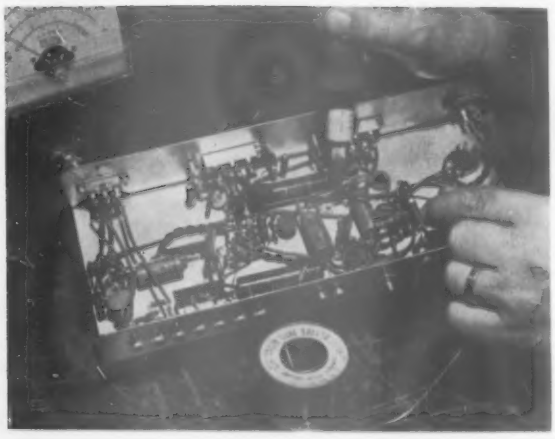
The automotive industry accounts for almost 45% of annual solder sales. Of every 100 lb used, 75 are for car radiators, and 25 lb for body filling. Radiators are generally made from copper parts joined by dipping them into a large pot of molten solder. Auto bodies, pock-marked or roughened by various assembly operations, are covered with body solder and sanded smooth.

Can makers use about a quarter of all solder produced. This, of course, is not the high-tin solder (40-60 tin-lead) common until World War II. War-time shortages forced a change in tin content of can solders, and most side-seam solders for tinplate are now 3-97 or 2-98 tin-lead compositions.

Can seam soldering is a form of hot-dip application in which the gas-preheated side-seam contacts a roll revolving in a molten solder bath.

The electrical manufacturing industry, third largest solder consumer, uses about 15% of the total solder tonnage. Soldered products in this field range from large motors and generators to radios, television and tiny electronic devices. The rapid expansion of printed circuits has been accompanied by automatic dip soldering of electronic units.

Remaining solder consumption, about 15%, is accounted for by use in miscellaneous manufacturing, maintenance and repairs. Sheet metal work and roofing, refrigeration and air conditioning, gas meters, auto repairs, dairy equipment, sanitary fa-



NON-CORROSIVE rosin-cored solder is used by worker on electronic unit.

*Assistant manager, Metals Research Department, Armour Research Foundation of the Illinois Institute of Technology, Chicago.

cilities and household repairs are major applications.

Tensile strength of tin-lead solders varies with composition (see table 2). However, such additional factors as wetting and capillarity, joint soundness, and type of base metal also influence joint strength.

Shear strengths may vary from 65 to 90% of tensile strength. In lap joints, strength factors are a combination of shear and tensile factors. Impact strengths of most tin-lead solders are satisfactory.

Due to aging, solders may lose up to 25% of their strength in one year and then remain constant with continued aging. Under constant load, a 40-60 solder can decline from a 6,340-psi tensile strength to 300 psi as shown in table 3.

Solder may be purchased in forms varying from massive pigs to fine powders. Since solders are always applied with fluxes, numerous solder-flux combinations are offered, such as the familiar rosin-cored and paste solders. Fluxes range from mild rosins and weak organic acids to strong inorganic acid-salt compositions.

Solder pigs weigh 50-100 lb; slabs, 15-30 lb; and ingots, 5-10 lb. Bar solders, with special shapes and names reflecting industry tradition, weigh from ¼ to 1½ lb in lengths up to 12 and 14 in.

Wire solder may be either solid or flux-cored; the latter is filled with acid or rosin. These wires can be as fine as 1/64 in. or as thick as 5/16 in., and may come in spools weighing less than a pound—or up to 65 lb.

Extruded forms (ribbon, strip, tape) are available in 12-in. or continuous lengths packed on spools of convenient weight. Thicknesses range from 1/16 to 3/16 in., with widths of ⅛ to 1 in.

Solder bars or wire may be cut into pieces or formed into special shapes or preforms. Advantages are *(1)* preplacement in difficult-to-reach locations and *(2)* quantity control.

Foil may be obtained in thicknesses from 0.00125 in. to 0.010 in. Packed on rolls 5 to 18 in. wide, foil weights range between 20 and 30 lb. Solder sheets 0.010 to 0.100 in. thick have maximum lengths and widths of about 36 by 24 in. Powered solder is available in mesh sizes of 50 to 200.

Soldering fluxes may be non-corrosive, corrosive, or may range between these extremes. It is always good practice to use the least corrosive flux capable of accomplishing the required application. Non-corrosive fluxes are typified by rosin containing abietic acid. Corrosive fluxes contain numerous inorganic acids and salts (*e.g.:* hydrochloric acid, zinc-chloride).

Organic acids or compounds are used in middle-range flux types. Residues from these fluxes require thorough cleaning after soldering to avoid corrosive damage in service.

With the exception of aluminum, most of the common ferrous and nonferrous metals can be soldered with tin-lead solders. Aluminum, however, requires a special zinc-base solder.

Steels, cast iron, stainless steels, copper and copper alloys, nickel and nickel alloys, lead and tin can all be soldered with various degrees of ease or difficulty depending on the wetting capabilities of the base metal.

ASTM Designation	Percentage Tin	Lead	Antimony	Silver	Fahrenheit Solidus[1]	Liquidus[2]	Pasty Range
70A-70B	70	30	*	—	361	378	17
60A-60B	60	40	*	—	361	374	13
50A-50B	50	50	*	—	361	421	60
45A-45B	45	55	*	—	361	441	80
40A-40B	40	60	*	—	361	460	99
40C	40	58	2.0	—	365	448	83
35A-35B	35	65	#	—	361	477	116
35C	35	63.2	1.8	—	365	470	105
30A-30B	30	70	#	—	361	491	130
30C	30	68.4	1.6	—	364	482	118
25A-25B	25	75	#	—	361	511	150
25C	25	73.7	1.3	—	364	504	140
20B	20	80	#	—	361	535	174
20C	20	79	1.0	—	363	517	154
15B	15	85	#	—	437	553	116
10B	10	90	#	—	514	573	59
5A-5B	5	95	*	—	572	594	24
2A-2B	2	98	*	—	601	611	10
2.5S	0	97.5	0.4	2.5	579	579	—
1.5S	1	97.5	0.4	1.5	588	588	—

[1]*Solidus: highest temperature at which metal is completely solid (melting point).*
[2]*Liquidus: highest temperature at which metal is completely liquid (flow point).*
**A types contain 0.12% Sb max.; B types contain 0.50% Sb max.*
#*A types contain 0.25% Sb max.; B types contain 0.50% Sb max.*

TABLE 1—Simplified chemical analysis, solidus, liquidus and pasty range of American Society for Testing Metals' tin-lead solder.

Composition Tin-%	Lead-%	Joint strength psi
5	95	3730
15	85	5300
20	80	5680
25	75	5700
30	70	5770
35	65	6100
40	60	6340
45	55	6420
50	50	6510
60	50	6850
63	37	6850

TABLE 2—Joint strengths of various tin-lead solders, based on lap joints between two pieces of copper.

Time under load Hours	Days	Years	Breaking load psi
0			6340
1			1600
10			1120
100	4.17		800
1,000	41.7		560
10,000		1.14	400
100,000		11.4	300

TABLE 3—Breaking loads for continuously stressed 40-60 tin-lead soldered joints, based on ¼-in. solder area between two brass plates.

PREHEATING of 28-ton roll was accomplished with a series of cylindrical pipes using coke as a fuel. Rolls were revolved slowly.

by **J. J. Matusek**
General Foreman
Inland Steel Co.

Submerged-arc welding reclaims blooming mill rolls

AN INCREASING NUMBER of steel mill rolls are being forged, rather than cast, and their composition is predominantly a low-alloy type.

To some extent, this factor alleviated some problems when obsolete blooming mill rolls recently were reclaimed by welding and converted to other uses at Inland Steel Co. Chemical composition, however, and particularly the carbon content, which helps these rolls withstand wear and thermal shock in service, did present a serious problem during welding.

With a change in groove sizes and pass widths, the 28-ton rolls could be converted into roughing rolls for a wide-flange beam of specific size. If successful reclamation were possible, purchase of a new set of rolls would be unnecessary and a substantial cost savings would be made.

However, this could only be done by welding new surface material onto the rolls where needed. As mentioned above, chemical composition, and above all carbon content, initially dictate if a certain steel can be electric welded and what particular precautions must be taken to insure satisfactory results.

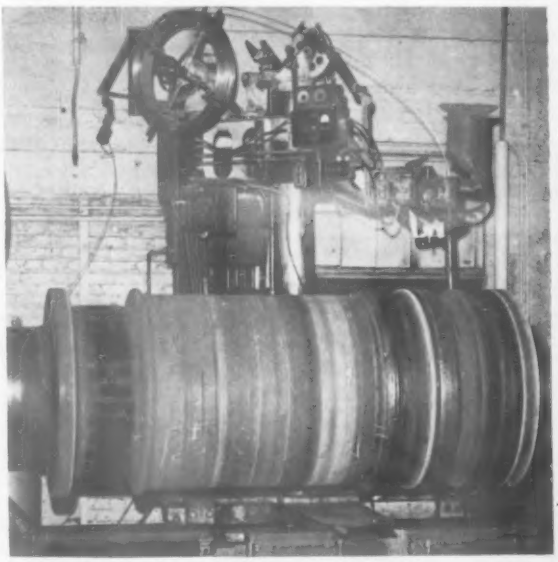
The rolls were in a high-carbon range with small quantities of alloyed ingredients. This high-carbon content would cause greater susceptibility to cracking when subjected to alternate heating and sudden cooling, and the hardened weld deposit would be unable to withstand the tension set up by contraction.

To counteract this cracking tendency, preheating was required. This would slow down local cooling (which follows the advancing pool of molten metal), and in turn minimize formation of hardened deposits.

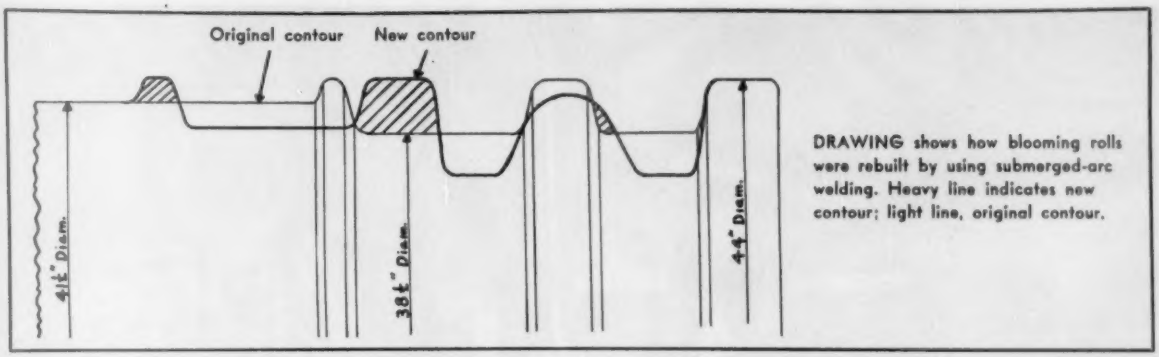
The rolls were first given a soaking preheat for 40 hours and brought to a uniform temperature of 150 F. Heat was then elevated at approximately 50 to 75 F an hour until the selected welding temperaure of 550-650 F was reached. This temperature was maintained throughout the entire welding operation.

A series of cylindrical pipes using coke gas as fuel were used to preheat the rolls which were revolved slowly. All preheaters were arranged so they could be moved if necessary and temperatures were checked periodically with temperature-indicating crayons.

Previous to preheating, of course, the rolls were undercut by machining. Outer surface condition of the roll will dictate how much, but in most cases, machining to 1/8 in. below the original surface will produce a clean



WELDING followed normal submerged-arc procedures, except that amperage was kept at the lowest point of the optimum range to keep dilution with the base metal at a minimum.



DRAWING shows how blooming rolls were rebuilt by using submerged-arc welding. Heavy line indicates new contour; light line, original contour.

crack-free surface for weld deposits.

Welding wire selection presented another problem. To obtain both limited hardness and service durability —and maximum thermal resistance to cracking, some compromise had to be made.

The wires selected had good wear resistance, possessed ability to withstand crack formation, and were in an economical price range. Consideration also was given to the machineable range of deposited metal.

Test welding was first done on a scrap roll to determine results of the welded surface layer. Simple and multiple passes were made to determine hardenability of the deposit when diluted by the high-carbon base metal, and the subsequent drop in hardness with successive passes.

The result determined the use of a soft, unalloyed wire on the three pass deposit for the surface layer. The wire had a low-carbon content capable of absorbing carbon from the base material without causing ill effects. Chemical range for the wire was: C, 0.015; Mn, 0.028; Ph, 0.003; Su, 0.025; and Si, 0.003. (These percentages are all maximum.)

On the intermediate layer a slightly alloyed, high-carbon wire was used. After three or four passes were made with this wire, a composition comparable to the wire itself was obtained and maintained. This tubular wire had a Rockwell C hardness range of 27-30. Its chemical analysis was: C, 0.16; Mn, 1.7; Si, 0.65; Mo, 5.0; Fe, balance.

For the final layer, a more highly alloyed, wear-resistant wire that could retain its properties at high temperatures was selected. The number of passes for the final layer varied according to the size of the overall weld. (Uppermost collar measured 44 in. in diameter.)

AFTER machining, the reclaimed roll was ready for new duties as a roughing roll.

This tubular wire had a Rockwell C hardness of 38-42, and the following chemical analysis: C, 0.50; Mn, 0.88; Si, 1.10; Mo, 5.5; Ni, 5.5; Fe, balance.

A 12 by 150 mesh size flux was used throughout, and all welding wires were ⅛-in.-diameter. Sufficient stock was maintained after machining to compensate for wear and ultimate dressing down during reconditioning.

Five factors weighed heavily in reconditioning of these mill rolls. *(1)* Once welding has started, it must be continuous. *(2)* Preheat temperature must be constant. *(3)* If there is interruption, care must be taken to prohibit roll cooling. *(4)* Extreme care must be taken in making all weld beads. *(5)* Any imperfections or lumpy welds should be removed before succeeding passes are made.

Recommended voltage and amperage, as suggested by the manufacturer, were used. However, care was taken to keep amperage at the lowest point of the optimum range for the initial pass in order to keep dilution with base metal at a minimum. Other than this, normal submerged-arc welding procedures were used.

Actual welding took 15 consecutive turns per roll. A total of 1,050 lb of welding wire and 2,000 lb of flux were consumed for each roll. Total cost of reclaiming the mill rolls was 17% of a new roll.

After completion of welding, if facilities are available, the roll should be stress relieved in a furnace. Temperatures should be raised to 1,100-1,200 F and held for 10 to 12 hours. The rolls should then be slowly cooled at a rate of 75-100 F per hour.

Lacking these facilities at Inland Steel, a combination metal and asbestos heat-shield was built around the roll. Temperatures of 800-850 F were maintained for 8 to 10 hours, then slowly decreased at a rate of 100 F per hour until completely cooled.

In service performance, however, is the real test of this reclamation operation. The two rolls have been used in two rolling schedules producing 2,969 tons—and visual inspection shows no more susceptibility to wear and cracking than the adjacent parent metal.

(Another pair of mill rolls, welded previously with a slightly different procedure, are also still in use. They have a record service of more than 12,000 tons, and have been re-dressed once.)

This welding procedure can be readily developed into a means of reclamation for prolonging the useful life of mill rolls and reducing the number of rolls ordinarily scrapped. And with careful selection of welding wire for the final layer, maintenance and conditioning costs can be substantially reduced as well.

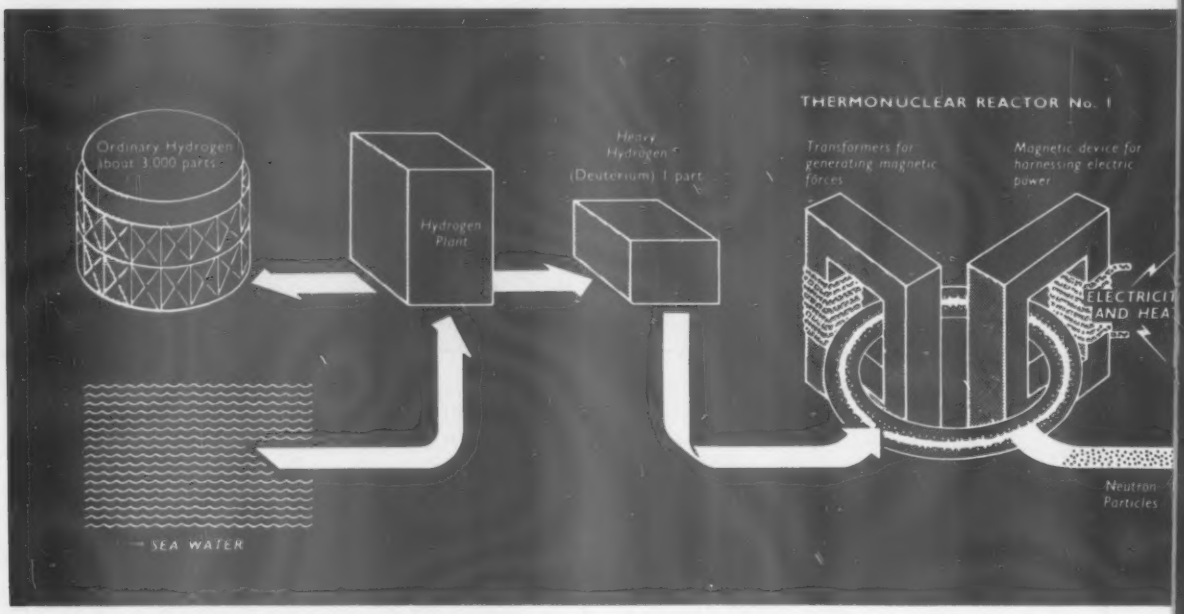


FIG. 1—A suggested method of obtaining power from nuclear fusion. Reactor No. 1, using deuterium obtained from sea water, provides neutron particles and a resulting tritium reaction with energy release in Reactor No. 2.

Part 4 — Thermonuclear fusion

A guide to nuclear power

by **W. D. Biggs**
Murex Welding Processes Ltd.

IN THIS SERIES, discussion has centered on fission energy, *i.e.*, atom breakdown into a product possessing less energy than the original, resulting in a release of surplus energy.

However, a converse reaction can also occur. Two atoms, each possessing a certain energy, are combined to yield a lower energy product, and surplus energy is again released.

Best example of this "fusion" is the collision of two deuterium or "heavy" hydrogen isotopes. The atom in each possesses a normal number of protons and electrons, as well as one neutron. When the two deuterium atoms combine, they produce an isotope of "light" helium and a considerable release of energy.

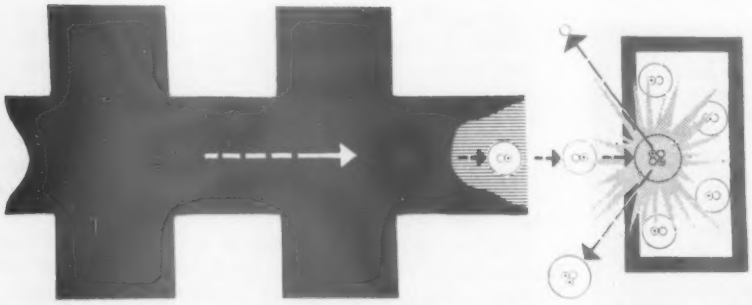
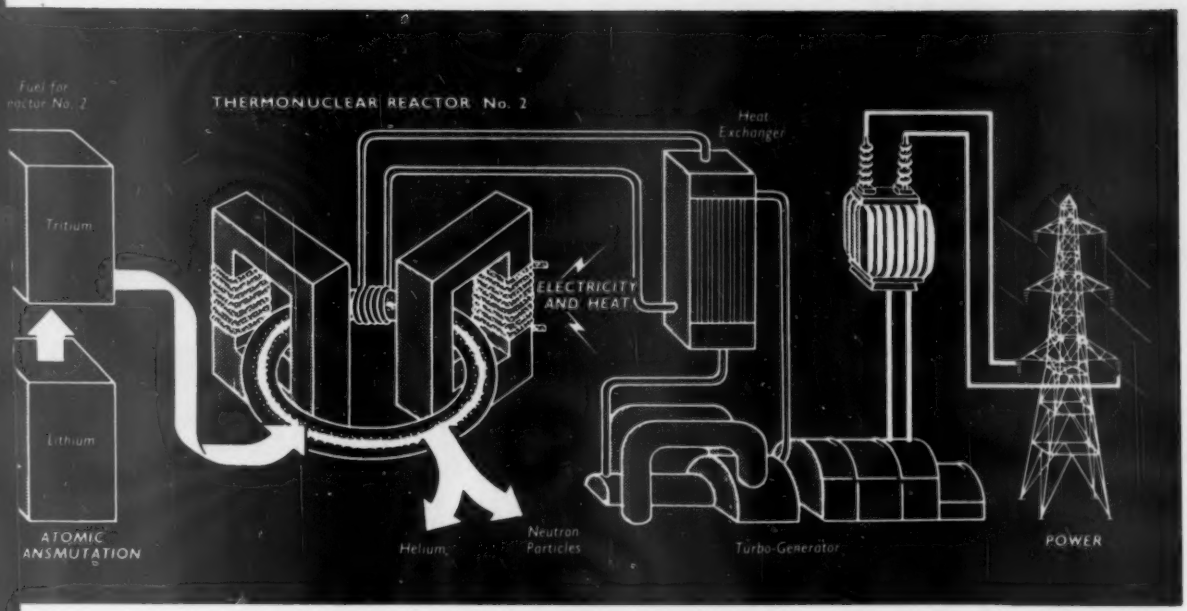


FIG. 2—Fusion reaction obtained by bombarding deuterium *(right)* with fast beams of deuterons from an accelerator. Fusion of two atoms gives energy, plus "light" helium and one neutron.

Deuterium nuclear reactions have been known for some 25 years. Most of the early studies were made in an apparatus in which the deuterons could be accelerated to high speeds and used as atomic "bullets." (See Figure 2.)

The target (another deuteron) was



extremely small and only a very small percentage of the accelerated deutrons produced "light" helium by collision and fusion. However, enough behavior occurred to permit a careful study.

It was apparent that a much higher number of "bulls-eyes" would be scored if all particles were moving fast. Although there would be an admittedly large number of misses, the scattering process would yield energy, and the entire moving mass would gain energy.

This problem of creating many fast-moving particles is not difficult —in theory. Modern concepts of physics state the characteristic of a gas, *i.e.*, that which distinguishes it from a liquid or solid, is the rapid movement of atoms or molecules. Thus, if the deuterium is hot enough, fusion will occur as a direct result of collisions between rapidly moving deuterons.

In practice, however, temperatures of several million degrees are necessary before even a measurable amount of energy is released. And if a break-even point is to be exceeded (where energy produced is more than energy consumed), even higher temperatures will be required.

The problem can be divided into two main parts:

(1) How to produce temperatures between 5 and 10 million, and possibly up to 100 million F, and *(2)* how to contain such temperatures in a vessel which will not be instantly vaporized.

Heating of deuterium is similar to neon lighting, in which an electric current is passed through neon gas contained in a glass tube.

[This principle is also the basis of plasma heat, a process in which gas is electrically heated to a point where temperatures of up to 30,000 F can be sustained. See *Plasma heat—newest addition to welding's product lineup*, WELDING ENGINEER, February, p. 50.—Ed.]

Operation of ZETA (zero energy thermonuclear assembly) at the Harwell research site of Britain's Atomic Energy Authority is based on this deuterium-plasma principle.

A high current is passed through deuterium gas, creating a heat-producing discharge within the gas. An intense magnetic field around the column of hot gas is also produced. The magnetic field causes a "pinch" effect in the column, making the gas even hotter (Figure 3).

Two desirable effects are realized. The gas is *(1)* made extremely hot so that atoms move with high energy, and *(2)* effectively compressed so that collision between deuterium atoms is more probable.

In principle, the second main problem has also been solved. If the hot gas confines itself to a narrow column at the tube center, there is no contact with the containing vessel. In practice, however, the discharge is extremely unstable. It tends to wriggle and collides with the vessel walls. This may vaporize the walls, causing impurities in the gas stream, and heat loss.

An externally applied magnetic field parallel to the axis of the tube keeps the pinched column of gas away from the walls (Figure 4). One great disadvantage in using a simple tube to contain the discharge is the

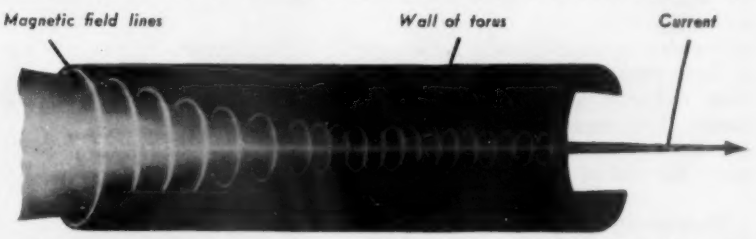


FIG. 3—Deuterium gas is confined by pinch effect. Current initially fills the whole tube *(left)*, but passage of the electric current draws the hot gas into a thin filament away from the walls *(right)*.

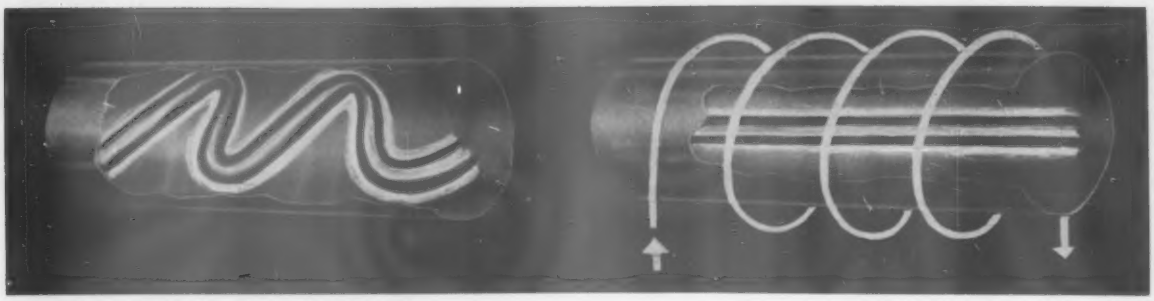


FIG. 4—The gas filament tends to wriggle *(left)* unless controlled by an additional magnetic field *(right)*.

heat loss occurring at tube ends where current enters and leaves.

By using a toroidal tube, the current produced by electromagnetic induction from outside travels in a circle. The basic unit then resembles an ordinary transformer with a column of hot gas in place of the secondary winding (Figure 5).

The ZETA torus is 118.11 in. in diameter with a 39.37-in. bore. Current is supplied by a bank of capacitors developing up to 200,000 amp for 0.005 seconds. This pulse is repeated every 10 seconds, during which continuous emission of neutrons is observed.

Keeping hot gas away from the wall is not merely a safety factor, although this is important. When pinch is not stabilized, there are two ways in which neutrons can be produced without deuterium fusion necessarily taking place.

Any deuterons which hit the wall can react with other deuterons absorbed on, or contained in, the wall material. On the other hand, if hot gas plasma breaks up into a number of irregular channels, neutrons may be produced by collision caused by these local disturbances and not be the main activating pulse.

In addition, wriggling causes a considerable loss of temperature as the hot gas gives up energy to the wall. The torus itself is therefore surrounded by a coil through which a fixed current flows, inducing a fixed magnetic field into the gas plasma. This suppresses the wriggle and the column of hot gas rarely strikes the wall of the torus.

Measurement of various physical quantities involved in thermonuclear reactions of this type is fascinating. Some of the techniques used are illustrated in Figure 6. To the layman the most significant factor is the temperature involved.

To refer to temperature without defining particular circumstances is misleading. Temperature of a domestic coal fire will be different if measured at the hearth front, in the center of the glowing coals or in the flue. All three values, however, will be representative and the significance of each will depend on the fire's use, *e.g.*, making toast, heating a soldering iron or heating a domestic water supply.

Conventional measuring methods (thermometers, thermocouples) cannot be used with nuclear reactions because of the vaporizing temperatures involved. So other less direct means must be used.

In one method, neutron or X-ray output is measured by a suitable instrument. From this it is possible to calculate a figure described as "value which a temperature would have to be in a quiet plasma in order to give the number of neutrons observed." However, because of the very high temperatures achieved, it is possible to use a more direct method, the spectroscope.

White light passing through a suitable prism is split into its seven component colors, each being associated with light of a certain wave-length. A spectroscope (or spectrograph) is used to sort the light into various wavelengths.

When the temperature of the deuterium gas is raised, the atoms move with increasing speed. As speed increases, the atomic nuclei continuously gain and lose electrons, causing an emission of light of a definite frequency.

A bright blue light is produced in the torus and, being of a single frequency, it would produce a single line in a spectroscopic image or on

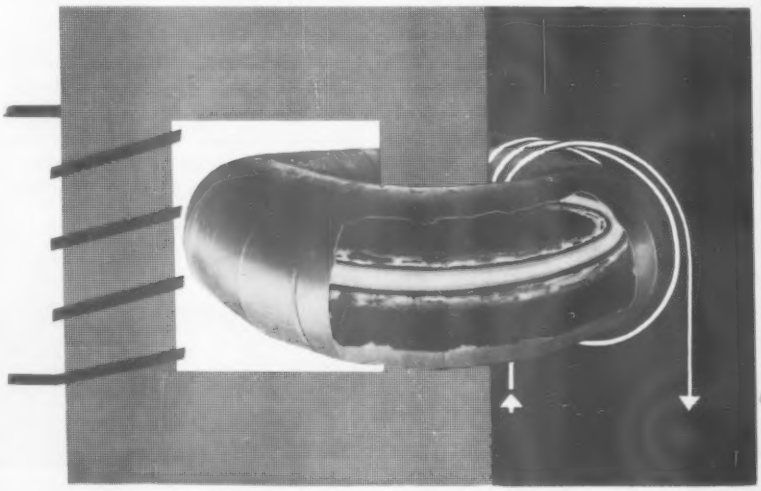


FIG. 5—Diagram of ZETA reactor. The electromagnet carrying the main current winding is shown on the left. Secondary winding for the stabilizing current is on the right.

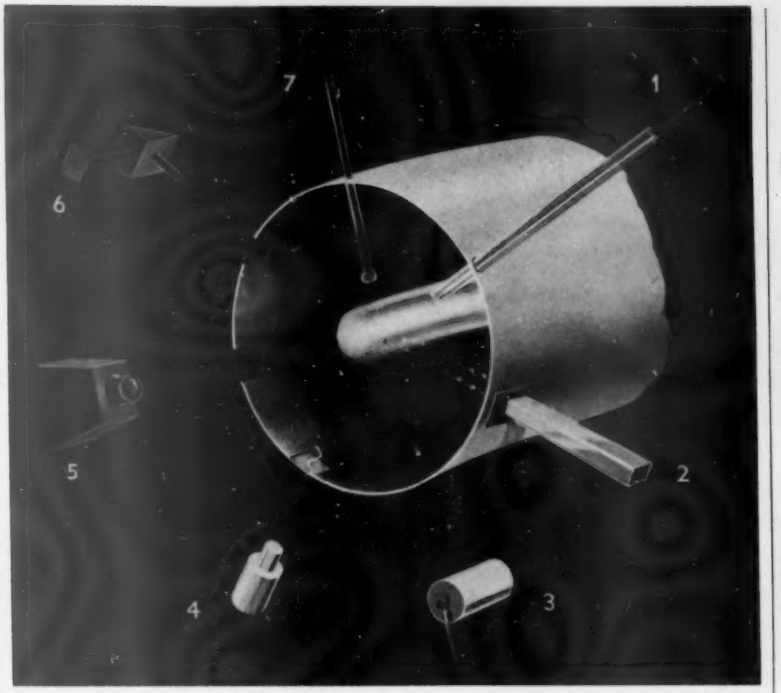


FIG. 6—Examination of a gas discharge. *(1)* Electron temperature by double probe. *(2)* Density and temperature by microwave beam. *(3)* Neutron counter. *(4)* X-ray output by scintillation counter. *(5)* High-speed photographs of the gas by image-converter camera. *(6)* Gas temperature by spectroscope. *(7)* Current distribution by magnetic probe.

a photographic plate. But the frequency of any electromagnetic vibration (light, sound, radio waves) depends on the source speed.

(This is known as the Doppler effect, which causes the pitch of a train whistle to drop as the train rushes past the observer, and is associated with the fact that sounds are "compressed" as the train is approaching. The same principle is used in some navigational aids and also in measuring movement of distant stars whose light appears more red [long wavelength] as they move further away.)

In ZETA the atomic nuclei are moving at speeds up to hundreds of miles per second in all directions, some toward and some away from the spectroscope.

Because of this the light emitted is not of a single frequency, but covers a range of values, and the idealized single line on the spectroscope becomes a fuzzy blob spread over a range of frequencies. So by measuring the breadth of the spectrum line, it is possible to determine the temperature of the gas.

Further studies are needed of the processes in ZETA by which neutrons are produced. This will ensure that the observed effects are due to the thermonuclear processes and not to side effects such as electric fields resulting from instabilities.

If the temperature is raised to 25 million F, the number of neutrons per pulse should increase about 10 thousand times. In order to reach the point at which the process breaks even, it will be necessary to obtain temperatures of 100 million F—and maintain these temperatures for periods up to several seconds.

In the light of experimental results obtained to date, there appears to be no fundamental reason why this should not be achieved. However, scientific and engineering problems which must be solved before thermonuclear power becomes a commercial proposition are many and complex. How and when the solutions will be found is still unknown.

[The editors of WELDING ENGINEER wish to express their thanks to *The Welder*, Waltham Cross, Herts, England, for permission to reprint this series of articles.]

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Missile welding headlines western metals show

QUALITY CONTROL on missile and aircraft welding will be among the topics discussed by the American Welding Society at the American Society of Metals 11th Western Metal Congress and Exposition to be held at Los Angeles, March 16 to 20, in the Pan-Pacific Auditorium and the Ambassador Hotel.

Other welding papers to be presented will cover major tooling for automation, high temperature brazing and structural welding advances.

New alloys and fabricating processes for general industry and for the missile, aircraft, rocket, electronic and petroleum production industries will be main areas covered at the exposition and during the congress.

Speakers are expected from all parts of the country and displays will be provided by more than 350 manufacturers. In addition to the ASM and AWS, the Society for Nondestructive Testing, the American Institute of Mining and the Metallurgical and Petroleum Engineers will conduct technical sessions.

AWS PROGRAM

Monday, March 16, afternoon session

"Welding techniques of low alloy high strength steels in the missile industry"
G. Harkins, Solar Aircraft Co., San Diego

"Welding of thin gage aluminum for the aircraft industry"
R. Longerbeam, Royal Industries Inc., Alhambra

"Fusion welding of precipitation hardening steels"
R. Meredith, North American Aviation, Downey

Tuesday, March 17, morning session

"Automatic applications on bridge fabrication"
C. Zwissler, Kaiser Steel Corp., Montebello

"Tungsten-arc cutting of austenitic stainless steel"
G. Conner, General Electric Co., Richland, Wash.

Afternoon session *(Brazing panel)*

"Brazing with flux"
S. Cross, Jr., Engelhard Industries, Los Angeles

"Basic requirements for dry hydrogen brazing"
H. Lewis, Pyromet Co., San Francisco

"Thermo fatigue of high temperature brazing"
R. Peaslee, Wall Colmonoy Corp., Detroit

"Multiple braze"—G. Cremer, Solar Aircraft Co.

Wednesday, March 18, morning session

"Tape-controlled Tig spot welding"
R. Hackman, Linde Co., Newark

"Welding applications on Thor ground support equipment"
C. Smith, P. Hookey, Douglas Aircraft Co., Long Beach

"Welding PH 15-7 Mo precipitation hardening stainless steel"
H. Smallen, Northrop Aircraft Inc., Hawthorne

"A practical design approach to resistance weld peeling loads"—W. Kraus, North American Aviation

Afternoon session

(Joint session with ASM on pressure vessels)

"UHS thin-wall pressure vessels—statement of problem"
D. Gunder, Polaris coordinator

"Welding of high strength alloys" (panel 1-hour)
Panel members—R. Meredith, chairman; A. Williams, Consolidated Western Div., U. S. Steel; G. Pritchett, Solar Aircraft; W. Tenner, Aerojet; E. P. Owen, Firestone

"FORMING"

"Explosive forming"—S. Carpenter, Convair, San Diego
A. Peterson, Lockheed, Burbank

"Hydro-spinning"—L. Allison, U. S. Steel

Thursday, March 19, morning session

"Problem areas in the Tig welding of a highly stressed pressure vessel"
W. Sponheimer, P. Simmons, Hughes Aircraft Co., Tucson

"Weldability of Thorium magnesium alloys"
H. Meredith, Airline Welding & Engineering, Hawthorne

"Welding of airframe components fabricated from 6AI-4V titanium alloy"
L. Crawford, Boeing Airplane Co., Seattle

Afternoon session

"Quality control of spot-welding shear strength"
W. Soward, North American Aviation

"Design of experiments as applied to welding"
J. Hurzeler, North American Aviation

"Fusion welder, continuous recertification"
L. Curran, North American Aviation

"46,200 welds per second"
C. van Pappelendam, C. King, North American Aviation

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Air Reduction Pacific Co.
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Engelhard Industries
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Gordon Duff Inc.
Eastman Kodak Co.
Eutectic Welding Alloys Corp.
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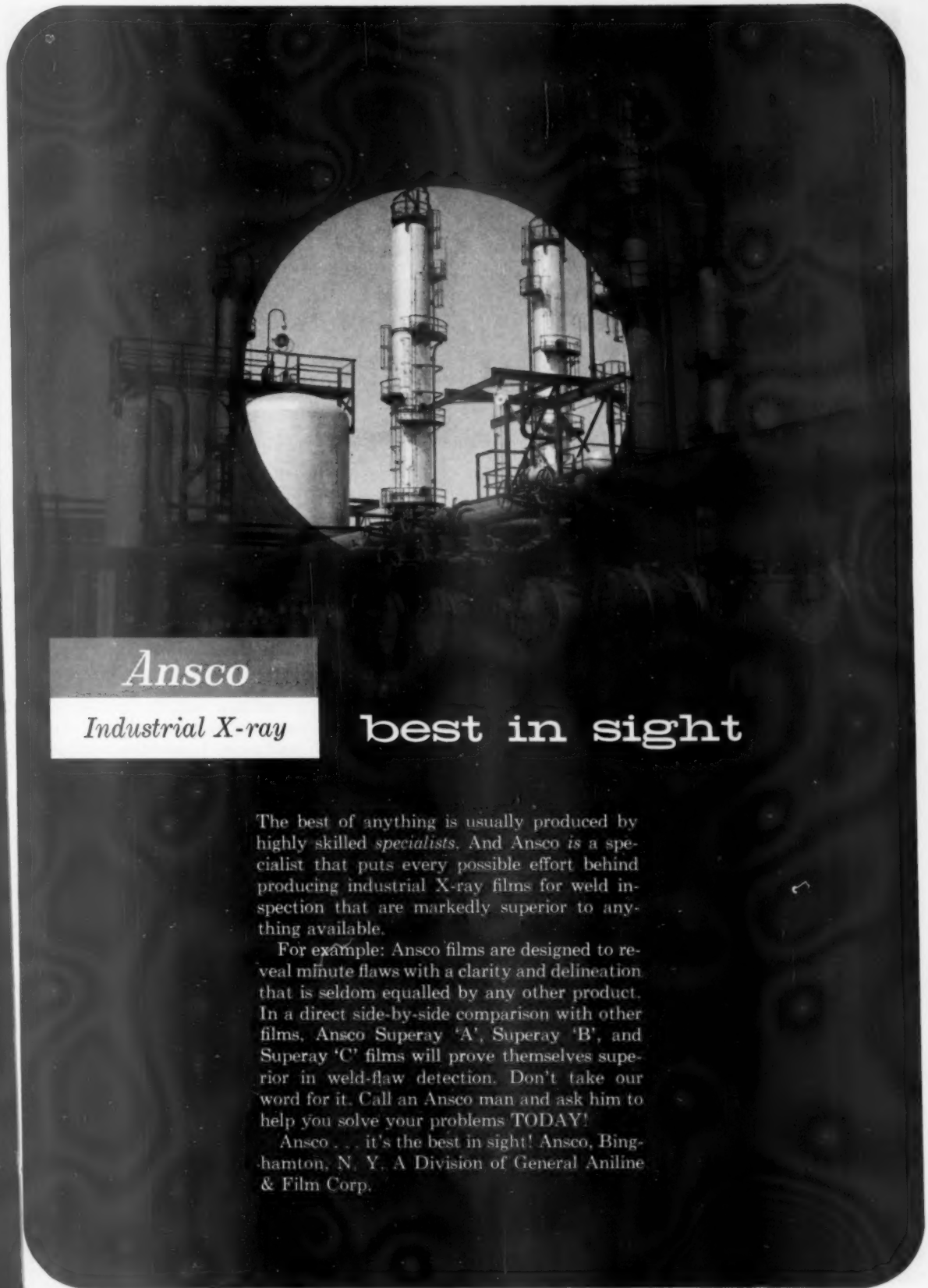

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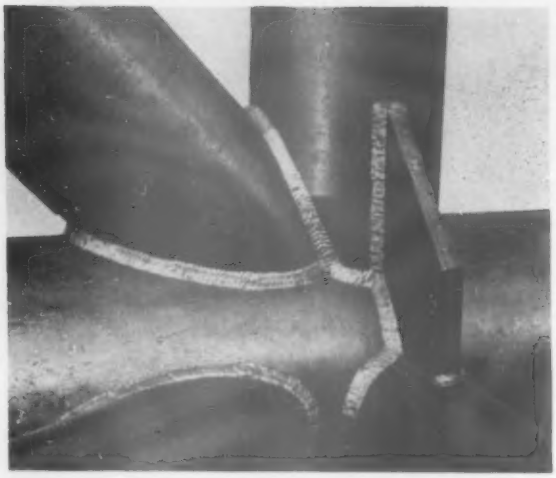


CRANEWAY bridge makes use of welded steel tubing. This particular joint is called "cruciform."

From one of Germany's leading steel and pipe producers— Phoenix-Rheinrohr A. G.— comes this account of tubular construction . . . and its design advantages.

Tubular construction takes hold in Germany

THE CHIEF CONCERN of designers in steel construction has always been to create structures combining maximum efficiency with esthetically satisfying form. Such designs have been realized where the designer consulted and emulated nature.

Eons ago, nature evolved structural forms for her creatures. Where it was important to support heavy loads on elastic, compact, torsionally-rigid uprights, the tubular cross-section became dominant.

The heavily-laden corn stalk, the slender bamboo trunk, the tubular bone and feather shaft—all are examples of functionalism wedded to beauty of form to provide matchless economy.

For thousands of years, man had relied upon tubular sections so plentifully supplied by nature in building many of his structures. Engineers Stephenson and Baker imitated the form when they bridged the Firth of Forth in Scotland during the years 1883 to 1889. They employed rolled steel and rivets to form 12-ft-diameter tubes that served as girders on the 1½-mile span.

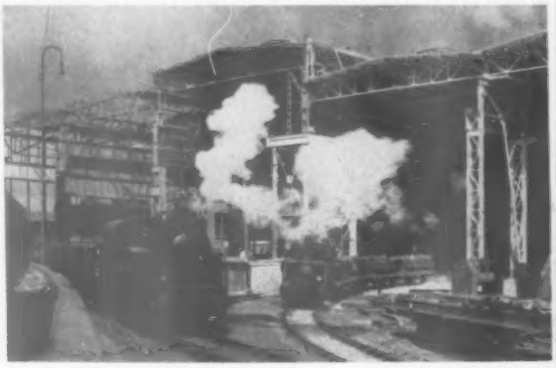
But riveting often failed to produce satisfactory connections, and it was definitely *not* the method for joining small-diameter tubing. Even the successful German production of rolled-steel tubing in 1886 didn't give engineers and designers the break they needed.

They were obliged to await the development of a means of assembly no less natural than nature's own structural element.

Fusion welding was the natural means, and it was German engineers in the 1920's who applied it to tubular-steel segments intended for structural use. The art of welding has advanced rapidly since that time, and along with it development of tubular-steel construction. The road, however, was not easy.

At first, tubular sections simply replaced angles and rolled sections, and gusset connections were welded instead of riveted. However, with the introduction of annular cross-sections, clean-looking, economical structures without gussets were possible.

As tubular construction developed, its use fell into two different categories. In the first, tubing was used only for uprights, columns, masts and booms. In the other, tubular members were integral with the whole structure, *i.e.*, welded trusses for elevated constructions, crane systems, antenna



FREIGHT shed roof of German Federal Railways is constructed of tubular-steel members and covered with porous concrete slabs.

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towers, bridges.

This gusset-less tubular construction offered many advantages: greater buckling and bending strength, less wind pressure, optimum sections, small surface areas, reduced thicknesses, moderate weight, beauty and economy.

Because of a tubular member's slenderness, buckling resistance is greatly increased. At maximum slenderness ratio, a tubular member offers efficiency advantages up to 500% more than straight-line sections of the same weight.

The tube's greater bending strength is ideal for beams used in pitched roofs, automotive fabrication or any other construction in which exposure to flexing stresses is unavoidable.

Rounded components, and the resulting decrease in frontal area, lessen the amount of wind pressure absorbed by the structure. This reduction in wind load is very important for those structures in which wind is the main load, *e.g.*, antenna towers, television installations, floodlight masts.

Rolling mills in Germany now produce tubular members in at least 10 different diameters. This variety has greatly aided designers in selecting optimum sections on the basis of stress analysis and in planning for tension members.

Another advantage of tubing over ordinary sections is less surface area. In terms of painting and paint consumption, this means fewer manhours and comparable cost savings. Lack of edges, corners and crevices speeds painting and increases paint life, as well as reducing maintenance costs.

Thus, tubing is most economical for use in chemical plants, fabrications exposed to polluted air, and in hydraulic structures.

The thinner tube walls (possible because of air-tight welding) and smaller cross-sections provide a pronounced weight savings. For designers planning construction of transports, crane booms, ore bridges and conveyor systems, this is a definite advantage because of the savings on power, brake equipment and fuel.

The last advantage is to the architect, who is able to follow natural design principles and can create structures with clean lines and a minimum number of members.

Considering all these advantages, steels with high elastic limits and excellent weldability make tubular construction highly economical over any period of time.

One seemingly great disadvantage in the use of tubular-steel construction is the high unit cost, and the fact that weld quality often varies from weldor to weldor.

The original cost of tubing, however, can be less in the long run because of its reduced weight. For example, a typical welded structure, including estimated maintenance for 10 years, can be as much as 20% less expensive than a similar unit of straight-line rolled-steel sections.

As for weld quality, Germany has a system of certifying weldors comparable to U.S. standards.

Only licensed contractors may erect welded tubular-steel structures, and the licensing requires an intense investigation of shops, equipment, weldors, foremen and engineers. And, of course, weld specimens must be submitted for inspection.

To earn the "0.9" rating, which permits a contractor higher allowable weld stresses and/or use of special materials, his entire organization must take a special examination.

The board of inspectors conducting the test is composed of construction authorities from state governments, and members of procurement agencies (*e.g.*, German Federal Railways).

One phase of the inspection deals with tubular joints having no gusset plates. In this case, particular attention is given to preparation of tube ends. (Formerly, tube ends were flattened to provide straight or angle terminal sections. Such connections, however, are not recommended for heavy-duty joints.)

Now, whenever possible, fabricators make a point of having the connecting tube half-enclosed by the connected tube. This insures absorbtion of transmitted loads and elimination of welds concentrated in line.

Struts and uprights or trusses must be cut so that curves intersect the tubular girders. There are three methods of accomplishing this: (*1*) with special cutters having the same diameter as the girder (which is expensive and creates welding problems); (*2*) by flame-cutting (which requires carefully prepared templates), or (*3*) with a tube-cutting machine.

TOWER is constructed of tubular materials, which give greater buckling and bending strength, and are effected less by wind pressures.

The tube-cutting machine is considered the best of the three. It flame-cuts to length, makes the curve, and bevels for the weld. No preliminary marking or finishing is required and much time and material is saved. The close-fitting joint insures greater weld strength and minimum assembly deformation.

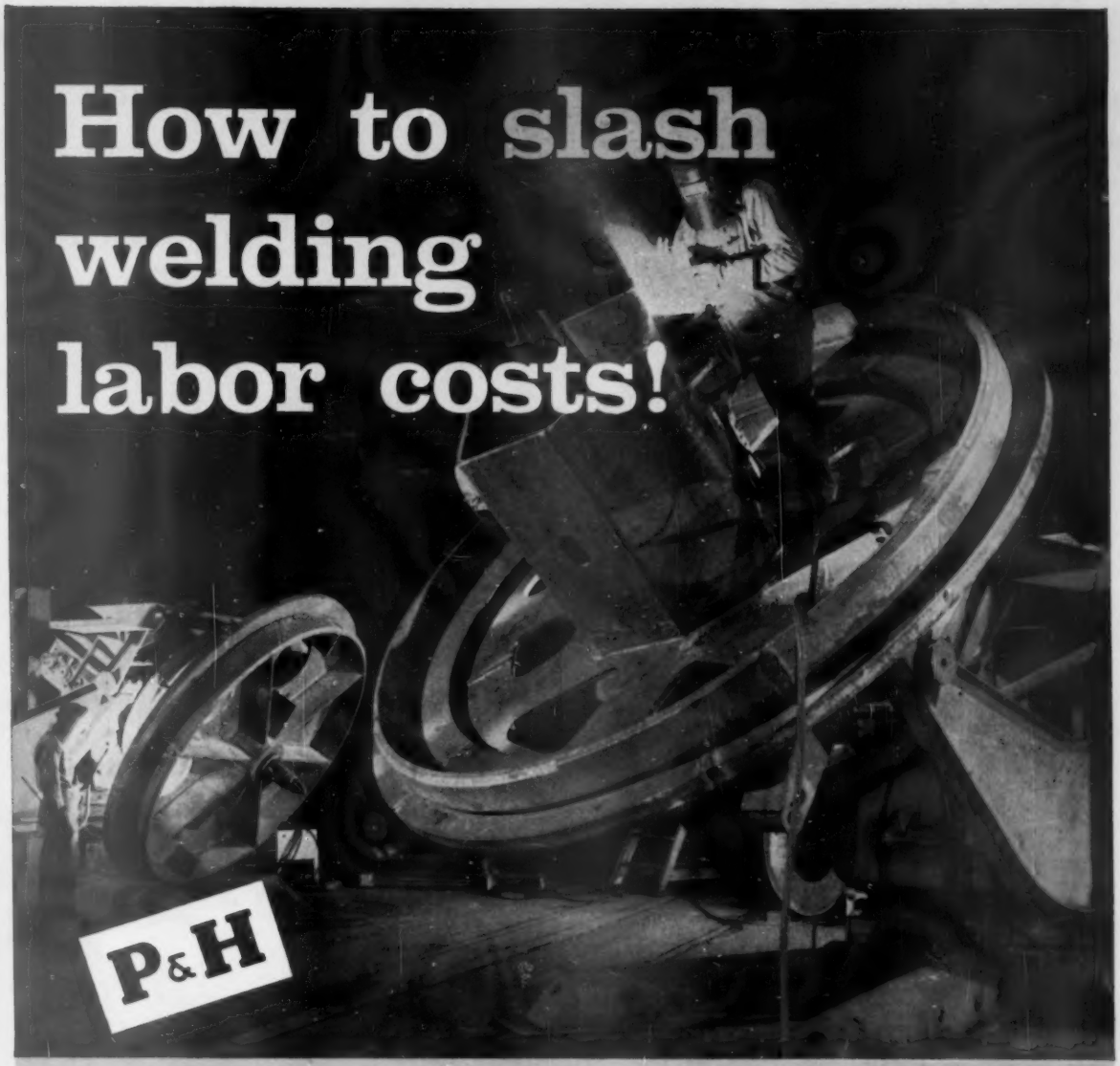
The advantages of tubular construction have been recognized throughout the world. In Italy, well towers, construction cranes, pedestrian overpasses and harbor installations have been erected using welded tubular materials.

Holland and Switzerland have built tubular-steel towers for high-tension lines, while Norway uses tubular-steel swinging cranes on all Oslo docks.

In England, tubular construction was used for one of the world's largest cable excavators for iron ore mining. The 1,750-ton excavator has a 250-ft tubular-steel boom of lattice construction. The 25-ton, 20-cu-yd bucket can swing 30 tons of ore through a 90-ft stroke over an arc of nearly 800 ft.

Tubular-steel construction may be a late-comer to Germany's arsenal of tools, but it is here to stay. And one thing is certain—it will soon take its rightful position in all civil and mechanical engineering applications of steel.

How to slash welding labor costs!



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P&H Welding Positioners can often cut labor costs in half by providing faster, safer, *mechanized* weldment handling. With these modern machines, operators merely press a button to quickly spot the work so that all welds are made downhand — in the natural position.

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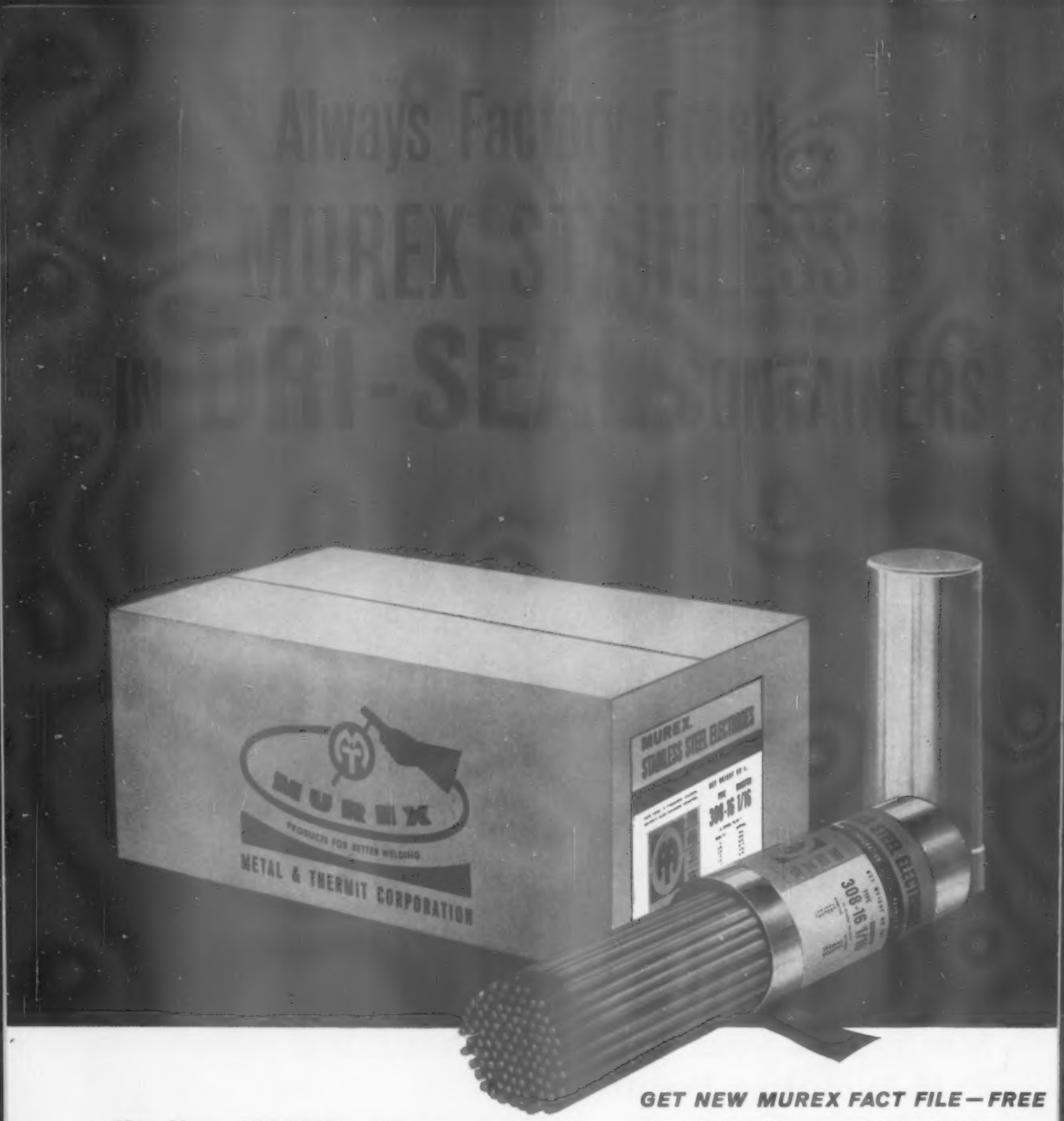

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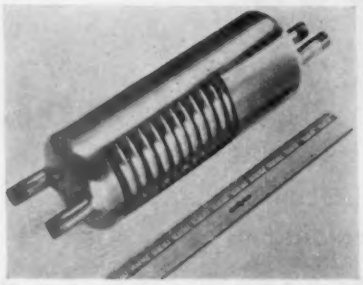


CUTAWAY model of welded stainless steam-sample condenser.

Steam analysis now possible with welded stainless condenser

MINERAL-CONTENT analysis of superheated steam has been made possible by a welded, stainless steel, steam-sample condenser.

Designed and manufactured by Technical Engineered Products, Inc., Kearny, N. J., the heat exchanger condenses 1 lb of steam per minute from temperatures as high as 1,100 F to 10 F above inlet temperature.

The condensate is analyzed to determine mineral content of steam in electric generating stations operating at high pressures and temperatures. Proper stainless steel material had to be selected to withstand these high pressures and temperatures, as well as for chemical applications.

Tig Welded

Because of its excellent high-temperature burst strength, a special columbium-alloy stainless was used to fabricate the welded tubing.

Carbide precipitation—main problem in welding stainless steel—was eliminated by the columbium, permitting use of the tubing in the as-welded condition.

All welding was done by the Tig (tungsten inert-gas) method using a type 316 electrode or similar electrodes having compositions which exclude the possibility of carbide inclusions.

Pipe extensions are 316 stainless steel, while the shell and all internal parts are type 304.

Because of metal thickness, edge preparation is not necessary. Where longitudinal shell welding is required, a copper backing strip is used to assure a tight weld. One particular problem was proportioning metal thicknesses to permit pressure-tight welds.

All welds are ground as smooth as possible and then polished. The fabricated vessels meet ASME code standards.

Testing Connections

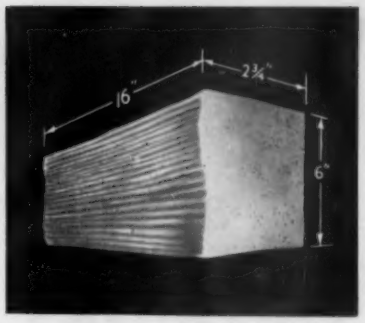
Testing of coils and welded connections is done hydrostatically, as well as with air under water. The hydraulic accumulator is capable of producing 11,000 psi of pressure; 150 psi for the air test.

All coils are tested at 7,000 to 8,000 psi prior to mounting into the casing. The cooler shell is tested at 200 to 300 psi and air tested at 100 psi. The casting is retested by air pressure after the unit is finished.

Because of their use, these small units may be dangerous if not properly supervised and checked. Therefore, all pressure testing is done by the company itself.

Condensate is cooled from its steam state at 1,100 F to water at 80 F. This is done through approximately 2½ sq ft of cooling surface (25 ft of ⅜-in. OD by 20-gage tubing) compacted into the 11-in. by 3⅞-in. diameter condenser. Five gallons of cooling water per minute at 70 F are required to produce the condenstate.

The company also manufactures a liquid-sample cooler, which is slightly smaller, but uses the same materials and is fabricated and tested in the same manner.



How long did it take to gouge out this 64 cubic inches of steel?

Fourteen hours' time were formerly required to chip 64 cubic inches of metal from a 5-ton reaction-type turbine casting. Using the Arcair cutting and gouging torch the job was done in 1½ hours, saving this company 12½ hours of costly, hard work, not counting clean-up time formerly required — and completely eliminated with the Arcair process!

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HOW DOES ARCAIR WORK?
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WHAT'S YOUR PROBLEM?
If you have a specific metal removal problem, or would like additional information, write us. Or, ask your welding supply distributor.

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MY PROBLEM

Welding costs are high —here's why!

√ overwelding
√ imitation castings
√ failure to use positioners
√ preventable distortion
√ unnecessary postheat
√ no mechanized welders

by **Bela Ronay**

"How can I cut my welding costs?"

This is the cry of many fabricators who depend on welding, but who also deplore what they call its "expensiveness."

Welding costs *can* be cut—not just slightly, but drastically! They can be cut by any designer or fabricator who tracks down and removes these six major causes of excessive welding costs:

1—overwelding;
2—use of fabricated components instead of structural shapes;
3—failure to use positioners;
4—correcting preventable distortion;
5—unwarranted postheat treatments;
6—lack of mechanized welding equipment.

Topping this list—and every list of its kind—is overwelding, which can readily put production welding costs into orbit. Perhaps one primary reason this waste of weld metal is so often condoned is that standard tabulations for welded fillet or butt joint shear values are not as widely distributed as are those for riveted joints.

But these tabulations *are* available, and the truth of the matter is that designers of welded fabrications often lack the background for computing shear values as was done in riveted construction. The simplicity of detailing welds (seldom given in units of less than 1/16 in. as compared to riveting's accuracy limits of 1/64 in.) has seduced them into weld metal extravagances.

As an example of overwelding, examine the fabrication of a structural base for use as a motor support. Four steel pads were to be welded to the top of the base, then drilled for bolt holes. To the pads would be bolted the motor mounts.

The designer of this base indicated overall dimensions of the structure, allowed for machining, chose a fillet size related to part thickness, then pencilled in a "weld-all-around" symbol. He did not take time, however, to determine fillet shear values and their relationship to that of the bolts holding the motor to the pads.

Each of the four motor mounts measured 3 by 4 in.; the bolts were ¾ in. in diameter. The steel pads—4 by 6 in. and ¾-in. thick—were to be welded with ¼-in. fillets.

Shear strength of the bolts was 5,600 psi. But the shear value of 20 linear inches of ¼-in. fillets is 64,000 psi—more than 11 times the strength needed to match that of the bolts. Had the designer estimated, even conservatively, the shear strength of these welds, he would have found that one linear inch of ¼-in. fillet weld has a shear strength of approximately 3,200 psi.

Computing on this basis, he would have known that only two linear inches of weld metal would be needed to equal bolt strength. Allowing for imperfections at the start and finish of short fillet increments, the practical solution would have been to straddle each of the four corners of every pad with 3-in. long fillets.

Such a design revision would have eliminated 32 linear inches of welds (welding all around the 4- by 6-in. pads required 80 linear inches of weld metal). It would also have created a saving in time: the all-around welds would consume 45 minutes, while the shorter welds could be made in less than 30 minutes.

There is an object lesson in this brief study of a design computation error—i.e., that there is a direct and crucial relationship between the strength of a welded joint and the service load it is intended to carry. And

Lincoln

WELDYNAMICS

NEWS ABOUT ARC WELDING AT WORK CUTTING COSTS

ATLAS SOLVES HIGH COST PROBLEMS

High welding costs were eating away at profits and making it tougher to bid competitively on heavy fabricating jobs at the Atlas Machine and Iron Works in Arlington, Va.

Werner Quasebarth, production manager and his brother, Bill Quasebarth, plant engineer, decided immediate action had to be taken. Since most of the work coming out of their shop is welded, it was natural that their welding operations come under scrutiny first.

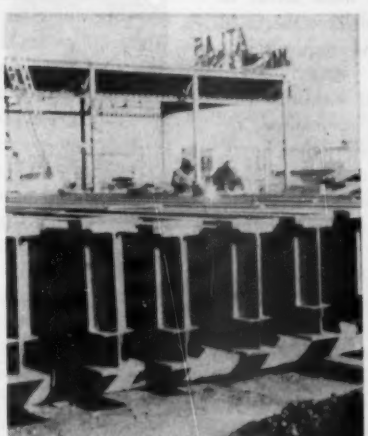
To help them analyze all their welding procedures and processes they asked Jim Clauson, a welding engineer from Lincoln, to conduct a survey of their shop in an effort to pinpoint inefficiencies.

Bill Quasebarth and Jim Clauson checked every welding operation in the shop. They compared electrodes and processes for operating factor, speed, weld quality and appearance. As a result of the survey several improvements were made which are expected to pay off in cost reductions of ⅓ or more.

Bill Quasebarth, Plant Engineer, found the way to cut costs and improve the product.

The most dramatic improvement was made on the process for welding cover plates on girders. Welding manually, Atlas welders have been able to complete 12 actual feet of $\frac{5}{16}$" fillet welds per manhour. By utilizing two Lincoln Mechanized "Squirt" welders which are capable of welding 50 feet of $\frac{5}{16}$" fillet per machine hour, Atlas was able to increase overall production 50% on this operation.

Bridge bearings are welded manually with iron-powder Jetweld electrodes.



Welding cover plates on bridge girders. A switch to semi-automatic has upped production 50%, improved weld quality.

For short welds, not accessible to the semi-automatic or automatic machines, iron-powder Jetweld electrodes were found to offer greater speed, higher operating factor and better welds.

Werner Quasebarth says, "We're grateful to Lincoln for helping us with our cost problems. We've learned from experience that the advice of Lincoln engineers is sound. We've been skeptical in the past, but we've found the Lincoln man is usually right."

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because too few designers appreciate the importance of this relationship, the average structure fabricated today is overwelded by 30%!

Traditionally, machine tool and production equipment beams, columns and struts have been castings. To obtain desired strength and rigidity, the walls, webs and flanges of these cast members are generously thick. Generously thick, but often far too large.

Obviously, excess casting weight and size has not always been objectionable. The justification for exceptional dimensions in cast iron is based partly on the fact that the metal is relatively inexpensive, and partly because it doesn't have great strength.

Unfortunately, many "modern" designers—blindly following tradition—create welded machine tool components that are carbon copies of their cast iron forerunners. Walls, webs and flanges are replaced by steel plates and bar stock—but thickness of the latter is the same as that of outmoded castings, and full-length welds are applied where intermittent beads would have sufficed.

This indiscriminate waste of steel isn't confined solely to replacing castings with weldments. It happens equally often on new designs. An example of this waste is evident in the fabrication of a column to serve as the principal part of a machine tool.

The structure, about 7 ft 6 in. long, was assembled by joining 1¼- by 14-in. web plates to 2- by 6-in. flanges. A total of 80 linear inches of ⅜-in. fillet welds were deposited to join these members.

Later, this unit was redesigned. In planning the change, it was found that two 8-in. channels, suitably spaced and joined by a lattice of flat strips, filled all strength requirements for the column.

The original column—an "imitation casting" at best—weighed 800 lb. Redesigned, the unit now weighs only 380 lb.

The first column required 80 linear inches of welds. Redesigned, it needed only 10 linear inches.

The redesign affected one further saving: *$220 in fabrication costs.*

Cost accounting departments in most plants do not furnish data on the cost per pound of weld metal in joints. If they did, shop supervisors would have the most persuasive figures possible to back their requests for welding positioners.

Such figures would show that vertical welding with 5/32-in. electrodes costs $4.50 per pound deposited, including material, labor and overhead. On the other hand, downhand welding with a 3/16-in. electrodes costs but $2.25 per pound. On heavy structures, when electrodes in sizes larger than this can be used, even greater savings will be made.

One argument against positioners is that they often require jigs and fixtures. In many shops there is a reluctance to "waste time" in designing and making these devices. However, experience has repeatedly indicated that such expenses are insignificant when measured against savings gained by downhand welding. Were management aware of these savings, it would tolerate no reluctance in making jigs and fixtures.

Time-consuming effort to correct distortion is yet another important factor in the high cost of welded fabrication. Supervisors and weldors know that welds shrink and that welding can distort original alignments. But engineering skill is necessary to predict the pattern and scope of distortion. If no engineering advice is available the most sensible procedure is to mock up an assembly from which to gather distortion data.

Cost of a mock-up is only a fraction of the amount that might be spent in reclaiming badly distorted weldments—or in scrapping a total part because of distortion.

Unwarranted use of postheat treatment also boosts costs into the higher brackets. Weldments to be finish machined are usually postheat treated to stabilize them. Of course, it is an engineering decision whether any individual unit should be so treated.

But when no engineer advises them, most plants work under the motto, "Take no chances, *postheat.*" Very often, however, a postheat treatment may be superfluous.

As an example of the factors governing such a decision, consider the structural base weldment described earlier. Four pads were welded all around, permitting residual stresses to develop in every weld.

These stresses tend to distort or *dish* the pads. As structural members, pads are flat beams; hence, for a given stress, pad distortion is a function of its thickness. Machining off a layer of metal may reduce pad thickness, but it does not affect the magnitude of residual stresses. These remain constant.

Consequently, unless the pads received postheat treatment before machining, distortion or dishing would only be intensified.

But if the pads were joined to the base by short corner welds only, as suggested, the stresses would be localized, and being localized, they could not exert enough leverage to cause distortion or dishing. Postheat treatment could, in this instance, be safely bypassed.

Postheating can be very expensive—particularly for plants that must ship weldments to another location for treatment. These plants soon learn that extra cleaning, loading and shipping operations can sometimes double fabrication costs.

To mechanize or not to mechanize? A logical answer to this question demands the concerted efforts of purchasing, engineering and production departments. Lacking their data, any other answer is merely guesswork. Yet it can be stated that mechanized welders will often result in great savings.

Most shop requests for such equipment, however, are turned down by management with the comment that the work is not repetitious enough to warrant purchasing mechanized equipment. In many cases, this is undoubtedly true. But there are more cases when it is *not* true.

Peak economy of manual welding is reached when the work is done downhand with ¼-in. electrodes. Weld deposits then cost about $2.00 per pound.

Using semiautomatic equipment, this can be slashed to $0.50 per pound when fillets are accessible and the work can be quickly positioned for welding in the flat. This economy can be realized even with short fillet runs.

These are only a few examples of welding errors that boost costs. Perhaps none of them plague your shop, but if they do, now is the time to correct them.

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Gunn cut, one-piece back. Wing thumb. Double thickness of leather on first finger and thumb. Lined on back of hand from wrist to fingertips. Full gauntlet. 14" long overall. Flat seam at palm base.

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Leather patch on back of hand gives added protection against sparks and molten metal. Thumb and first finger reinforced with leather patch. Reinforcing leather strap around thumb. Full gauntlet. 14" long.

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In the swim –
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Transform a hole in the ground to a welded steel pool

WELDORS work on corner of L-shaped pool at Ridgway.

RIDGWAY STEEL FABRICATORS, Ridgway, Pa., provide everything from the hole in the ground to the lifeguard's chair when constructing all welded steel swimming pools.

Ridgway uses steel to assure cleanliness and long pool life. Steel's strong, smooth surface helps maintain hygienic conditions because it will not crack and give bacteria and fungi a place to breed.

Steel's durability is another one of its advantages. A report in *Park Maintenance* magazine says steel swimming pools built 25 years ago are as good as new today, and still require only minimum maintenance.

One more factor in favor of steel is that it provides a smooth surface to which paint readily adheres, so basic colors and necessary safety instructions can be easily applied.

High-carbon, copper-bearing ¼-in. steel plate, in sheets 7½ ft wide and 35 ft, 10 in. long, are supplied to Ridgway by Jones & Laughlin Steel Corp., Pittsburgh.

The plates' uniform size eliminates a need for trimming and speeds construction. Country club pools at Ridgway and St. Marys, Pa., were completed in less than two months by an eight-man crew.

Basic fabrication is handled in Ridgway's shop, where side and end plates are shaped and scumgutters bent to specification. The plates to be used for the pool's bottom are treated with an asphalt enamel. Supports, such as angle irons, concrete anchors and A-frames, also are fabricated in the shop.

While shop work is being done, Ridgway crews excavate the pool site, install filtering apparatus and prepare the foundation.

A 6-in. layer of screened gravel is laid beneath bottom plates, and is extended up the walls when construction nears completion. The gravel gives good drainage and eliminates hydrostatic pressure against pool walls and bottom.

After shop fabricated components are shipped to the site, crews weld bottom, side and end plates in place, using manual metal arc welding. Welds are then ground flush and the pool is sandblasted. Four coats of vinyl paint are applied to the steel surface—eight coats to welds.

Bottom plates are supported by horizontal beams, side plates by guide stiffeners made from angle irons. Additional support is afforded by A-frames and lateral scumgutters.

Upon completion of construction, excess excavation areas are filled and leveled, a concrete apron is laid around the pool and the pool area is landscaped and fenced—all by Ridgway.

To complete their all-inclusive service, Ridgway provides and installs diving boards, lights, ladders, heaters and lifeguard chairs.

MAN in foreground is grinding welds, men in background are welding end plates for Ridgway pool.

COMPLETED pool at St. Marys Country Club. Equipment shown, fence and concrete apron were installed by Ridgway.

Army, too, uses the welding shop

The civilian welding shop is called upon to perform a variety of tasks, and this is true, too, of the U. S. Army welding shops around the world.

The army weldor has big jobs, such as repairing bulldozers, cranes and 25-ton trailers, and small jobs, such as fixing typewriters and radiators, during a day's work. But he also has many unusual jobs come his way.

Frank Schmidtmann, formerly a Senior Weldor stationed with the 37th Engineering Battalion in Germany, recalls two unusual jobs he and his two-man crew tackled during their three years in the army.

Hand pumping of diesel fuel from 55 gallon drums was a dangerous, time-consuming job until Schmidtmann, his crew and welding came on the scene. They fabricated a 500 gallon tank from ½-in. steel plate, welded it to 20-ft L-beams and added a 3-in. hose. The result—diesel engines fueled safely and quickly by gravity flow.

The cracked bellypan of a bulldozer presented another problem. The pan had been previously fixed with a soft metal, but after some use the metal started to wear away, allowing oil to leak.

Welding was used to fix the pan the second time. The bulldozer had to be placed over a grease pit for the job, and overhead and vertical welding techniques had to be used. Though all the oil was drained from the engine, two men armed with fire extinguishers stood by as Schmidtmann entered the pit to start work.

A 7-in. hole was cut in the ¼-in. plate and a patch tack-welded in place using consumable electrodes —without mishap.

One year later, when Schmidtmann left the army, the bulldozer was still operating without any sign of leaking oil.

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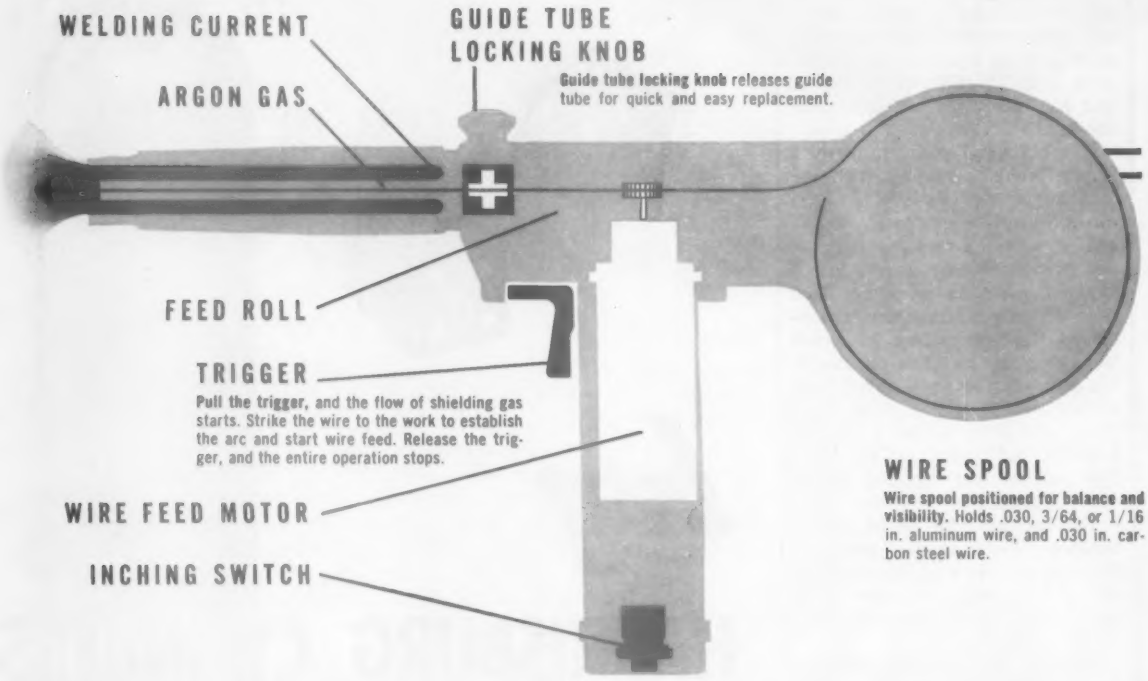
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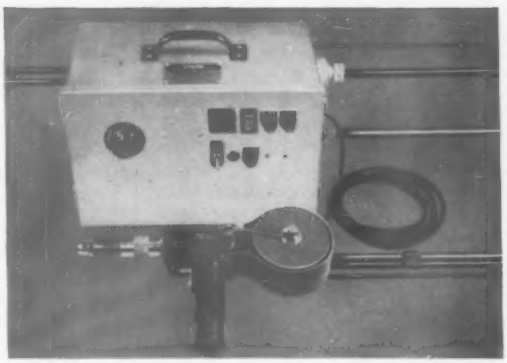

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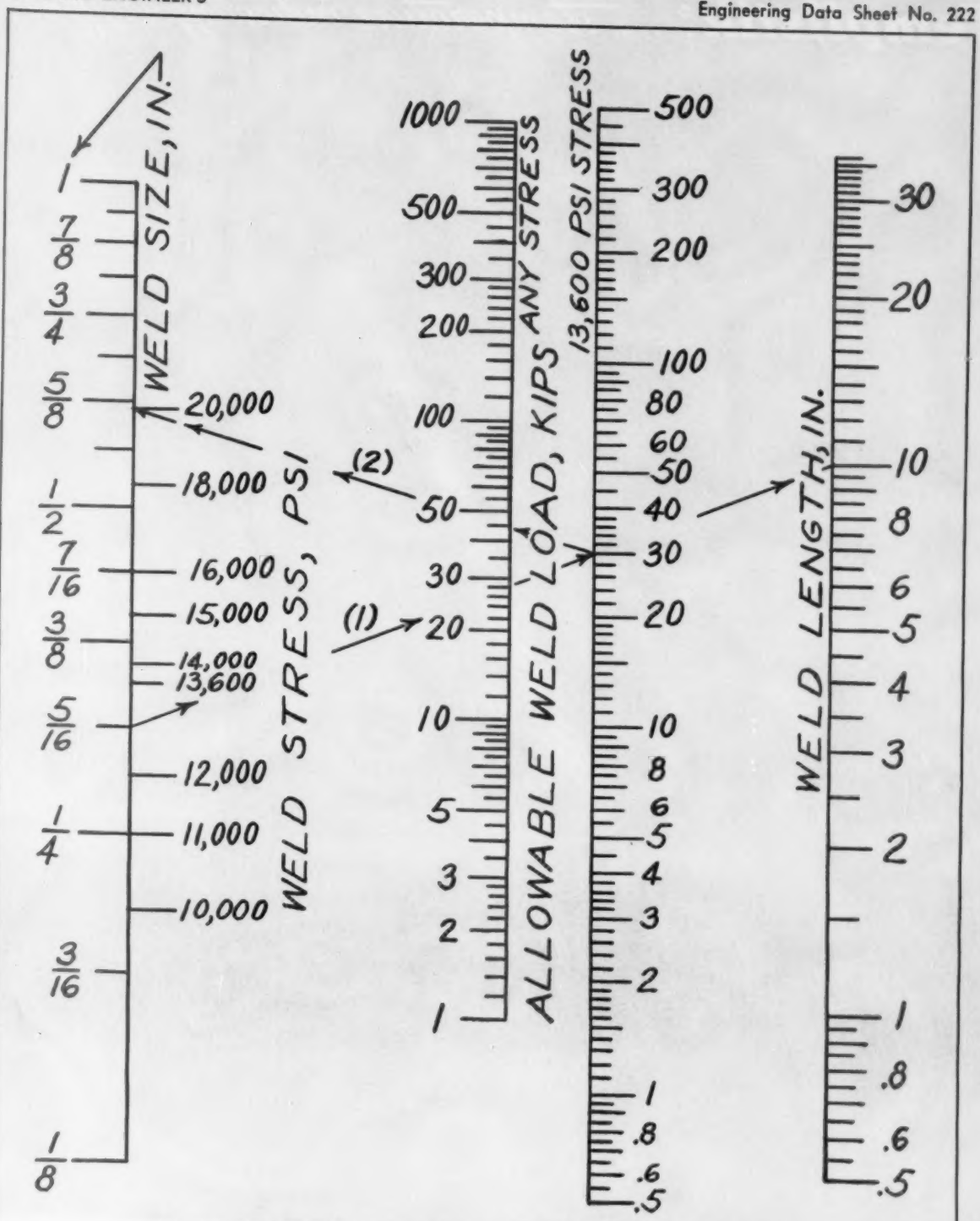

ALLOWABLE LOADS ON FILLET WELDS

by **Steven D. George**

Compute allowable loads on fillet welds from ⅛ to 1 in. with this chart. Based on the commonly used stress of 13,600 psi, the chart can also be used for stress values from 10,000 to 20,000 psi.

Example: What is allowable load on a 5/16-in. fillet 10 in. long if stress developed is 13,600 psi? Determine allowable load on the same weld if stress developed is 20,000 psi.

Solution: Enter chart on the left at weld size (5/16 in.) and draw a straight line (1) through weld length (10 in.) at right. At intersection with third scale stem from left, marked "13,600 psi stress," read allowable load as 30 kips=30,000 lb.

To determine allowable load for 20,000-psi stress, draw straight line (2) from value of 30 kips through weld stress (20,000 psi) on the lefthand scale. At intersection with second scale stem from left, marked "any stress," read allowable load as 44 kips=44,000 lb.

Chart is based on P=9.6 SLX/13,600, where P=allowable load on weld (kips); S=weld size (in.); L=weld length (in.); X=allowable weld stress (psi).

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EXHIBITS at the convention ranged from displays of ironwork (left) to demonstrations of steel stock shearing (right). Running the demonstration is A. H. "Doc" Lehman (with ruler) of Bateman Machine & Foundry Co.

NEWLY-elected officers of NOIMA (left to right), seated, Bud Colver, first vice president; Frank Kozik, president; A. H. Jones, second vice president; Dominic Taverna, secretary-treasurer. Standing, Bob Hairston, executive secretary; A. Butlak, Vernon McFarland, Vernon Stiles, Jim Kathman, Melvin Peterson, and J. W. Brown, board members.

NOIMA at Atlanta . . .

Convention, school and exhibits

by **T. B. Jefferson**

HOME OWNERS throughout the country have kept ornamental iron fabricators busy providing railings, stairs and other ironwork for the more than one million new homes being built each year.

But the busiest time of all for some 100 of these fabricators was the four days spent at the National Ornamental Iron Manufacturers Association's convention early in January at Atlanta, Ga.

Convention activities began Jan. 8 at the Atlanta Biltmore Hotel after a pre-convention day of meetings of the board of directors, and an "early-bird" reception sponsored by Bateman Machine and Foundry Co., Mineral Wells, Texas.

The NOIMA convention included sessions at the Ornamental Iron Academy, and a trade show and exhibit (where the latest developments in castings, machines, component parts and forges were displayed).

Two formal addresses were made during the convention. Patrick Gannon of the National Association of Home Builders spoke on ornamental iron for the home builder. The second address, by Elmer Wheeler on the second afternoon of the convention, was entitled, "How to put the sizzle in your sell."

In the eight sessions at the school, delegates heard lectures on sales and financing, layout, cutting and grinding, fabrication, cleaning and grinding, priming and finishing, installation, records and office procedures, and collections. Discussions followed each session.

The three-day convention, however, was not all work. Tours of Atlanta and daily luncheons were among the lighter activities.

The convention ended with a banquet and dance. Entertainment for the affair was provided by Tennessee Fabricating Co., whose president, Abe Sauer, acted as master of ceremonies. The acts were brought in from New York, Las Vegas and Puerto Rico.

Final business of the convention was election of officers for the coming year. Newly-elected executive secretary Bob Hairston outlined the association's proposed activities for 1959, which included publication of its magazine, "The National Ornamental Iron Fabricator."

The association also plans to promote industry standards, consumer research, standard bookkeeping systems and a film for industry promotion. Next year's convention will be held in New Orleans.

Among exhibitors at the convention were: Marks Oxygen Co., Bateman Machine and Foundry Co., Tennessee Fabricating Co., M. B. Parker & Co., Lawler Machine and Foundry Co., Champion Blower and Forge Co., Julius Bloom & Co., and Hallemite Mfg. Co.

Safety, acetylene chemistry featured topics of IAA annual convention

Stanley B. Kirk
Morehead Medalist
1959

SAFETY AND ACETYLENE CHEMISTRY sessions and the presentation of the Morehead Medal will be high points of the International Acetylene Association's 61st anniversary convention to be held in the Roosevelt Hotel, New Orleans, March 9 and 10.

Acetylene as a raw chemical will be the subject of the technical session Monday afternoon, March 9. Charles F. Bonnet, plant manager, Fortier Plant of American Cyanamid, New Orleans, will present a paper on the chemical uses of acetylene.

Following the paper, the IAA transmissions committee will make a report on the industry-wide guide it is working on covering transmission systems.

Chairman of the committee, Wayne Y. Scofield, Air Reduction Co., Inc., will report. He will be assisted by Committee members D. Demianiw, Dr. W. B. Howard, W. N. Milks and W. G. Schepman.

The Tuesday, March 10, morning session will be devoted to plant safety and safe practices in using oxyacetylene processes and equipment. A panel discussion will be conducted with panelists from the industry and the National Fire Protection Association.

Stanley B. Kirk, former president of Linde Co., New York City, will be presented the James Turner Morehead Medal for service to the industry at a dinner Monday evening.

Kirk's work and contributions to the acetylene industry will be outlined by Charles Haines, president of Chemetron Corp., and Dr. A. B. Kinzel, vice president—research, Union Carbide Corp., and the 1954 medalist.

Always a special feature of the IAA convention is the technical know-how exchange session. This year's discussion, to be held Tuesday afternoon, will cover cleaning of equipment for oxygen service.

Also on the convention program is a board of directors' meeting, council of past presidents' dinner and the annual business meeting.

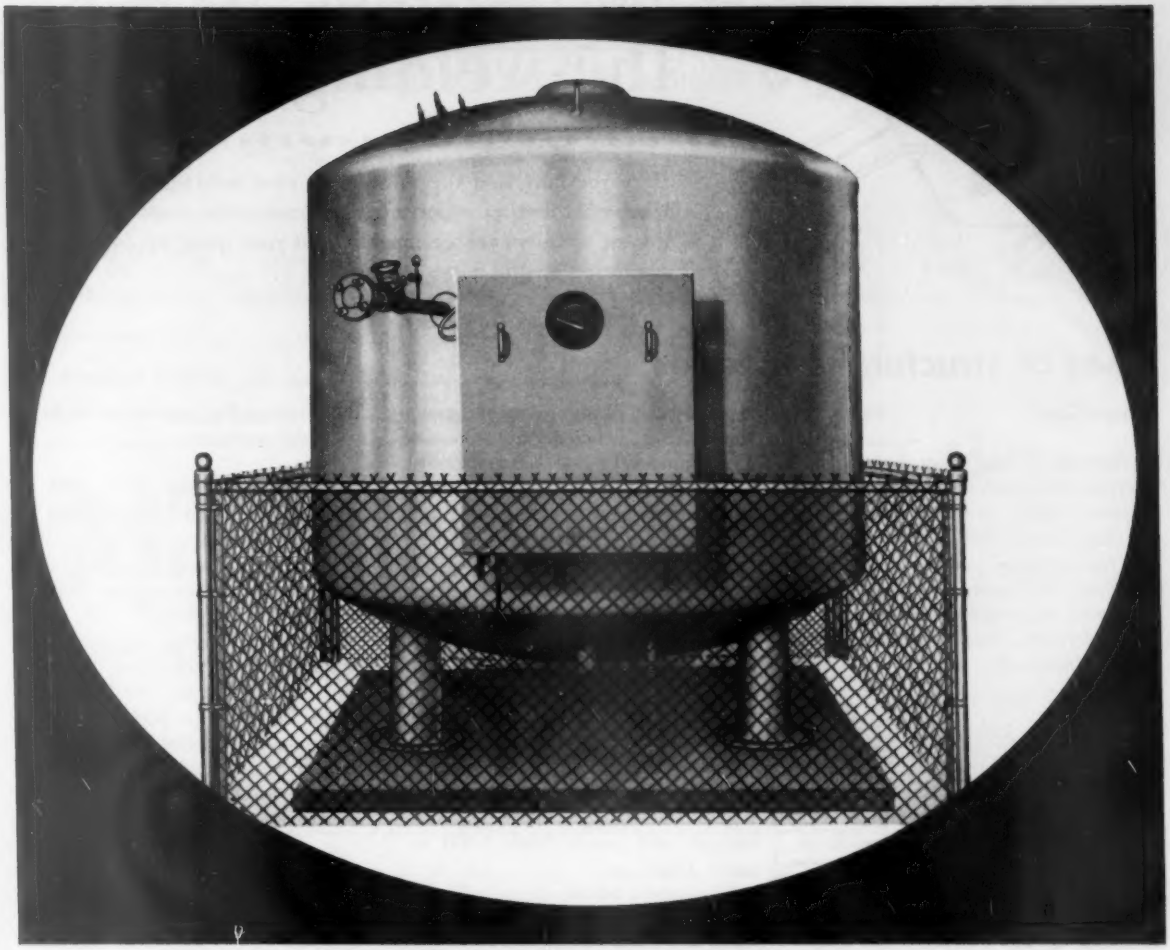
Keynoting the convention at the opening day luncheon will be John R. Callaham, editor of *Chemical Engineering*. He will present "Today's research—tomorrow's world," a discussion of new developments and a forecast of their future importance.

President of the IAA, H. S. Sutherland, Shawinigan Chemicals Ltd., and Mayor deLesseps S. Morrison of New Orleans, will welcome conventioneers at the luncheon.

Another highlight of the convention will be New Orleans itself, a city of glamor and excitement which offers conventioneers many ways to make the meeting enjoyable as well as educational.

For those who like to sight-see, a taste of the old world can be had at the French market, opera site and Napoleon's house. For those who like a taste of something more filling, the city's many French restaurants offer a variety of dishes. Theaters and sight-seeing tours offer other means of entertainment.

MAP shows downtown New Orleans, key giving some places in Roosevelt Hotel's (38) vicinity. Joy (36), Orpheum (37), Center (39), Strand (48), all theaters; Maison Blanche (21), Galatoire's (23), La Louisiane (29), D. H. Holmes (30), Kolb's (42), all restaurants.



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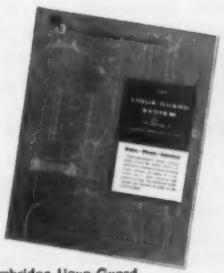

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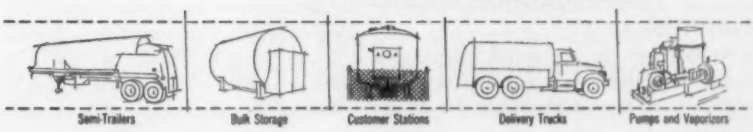
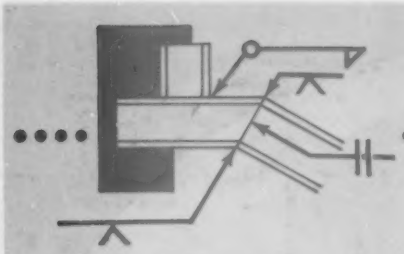




the welding clinic

Here you may find the solution to your welding problems, whether they concern design, production, construction or maintenance welding. Submit your questions for answering on this page.

Uses of structural adhesives

Question:

Recently I have been hearing numerous references to "structural" adhesives, which are being used for joining certain metal parts instead of the conventional means of mechanical fasteners or brazing. Could you give me some information on the general characteristics and application of these adhesives?

Answer:

The term structural adhesives is applied to a very select group of extremely high-strength adhesives used for joining metal parts.

Usually considered in this category are the epoxy resin adhesives. Also included in the grouping are those adhesives made from combinations of synthetic elastomers and resins which cure with heat and pressure.

Use of structural adhesives is a skilled operation, and requires the proper equipment and control of the bonding operation. Care, attention to detail and familiarity with the particular adhesive are necessary.

These adhesives offer a great potential cost-savings. They can be used in assembly operations which previously were done only with mechanical fasteners (bolts or rivets), or fusion processes (spot welding and brazing).

By using structural adhesives in those applications where they can properly replace the conventional joining processes, the cost in terms of time, equipment investment and subsequent machining can be satisfactorily reduced.

According to Minnesota Mining and Manufacturing Co., structural adhesives have been included in the design of such parts as flexible spouts for oil cans, helicopter rotor blades, aluminum scaffolding, pump castings, end-plates for pneumatic tool motors and certain aircraft parts.

These structural adhesives are presently being investigated for possible application in joining auto and truck body components and other transportation equipment. One other advantage of these adhesives, other than their high strength, is the improved resistance to joint fatigue.

Bonding strength of structural adhesives is impressive. When used to bond aluminum to aluminum, shear strength will range from 3,000 to nearly 13,000 psi.

Most epoxy adhesives are cold-setting, or cure chemically at room temperature. However, although they have excellent adhesion to metals, ceramics, glass and other surfaces, they are generally hard and somewhat rigid when completely cured. The elastomer-resin combinations are also high-strength, but retain a considerable amount of flexibility even after curing.

Nearly all structural adhesives have good resistance to water, moisture, oil, and mild acids or alkalis. Some are also resistant to ethyl alcohol and similar solvents.

Functional temperatures for structural adhesives range from as low as —65 F to as high as 350 F for some of the heat cured types.

Epoxy resin adhesives are liquid and can be applied either with a brush or knife. Contact pressure only is needed for this type.

On the other hand, elastomer-resin combinations are sometimes liquid, but are also available in dry film form. The film is applied by laying it between the bonding surfaces and then joining the materials to be bonded under pressure.

Pressures from 50 to 200 psi are required when bonding with the elastomer-resin type adhesives, and these pressures are necessary while maintaining a temperature between 250 and 375 F.

Before attempting to use any of these structural adhesives, the individual manufacturer should be consulted. If used properly, they can save considerable time and money in many operations. However, improper use can result in bond failure and unsatisfactory parts.

Question:

Are jigs and fixtures always necessary when gas welding?

Answer:

Appearance of a welded product is often dependent on edge alignment. Degrees of care exercised in aligning parts will vary with different jobs and materials, *e.g.*, steel plate can be welded without jigs, but aluminum pieces often require it.

When welding certain materials, especially thin-gage aluminum, welding heat can be quickly dissipated by using a fixture fitted with chill blocks. The grooved back-up bar will help control the underside shape of the weld bead.

Jigs are also used to speed welding operations when many identical pieces are being made.

Carbon blocks and rods, or carbon paste, are often used as a substitute for jigs and fixtures, especially when repairing castings, since they are available in many sizes and can be given any needed shape.

NEW

CURTISS-WRIGHT

RADIOGRAPHIC

PUFF CAMERA

Rapid source advance to remote areas... Complete operator safety... No film fogging

ALL-PURPOSE CAMERA • 10-2
Handles 20 curies of iridium. Small, rugged and compact for hand portability. Capable of 60 degree beam or panoramic exposure.

EXTERNAL PIPE LINE CAMERA 10-1 Handles 25 curies of iridium. Designed for safety and accuracy in field exposures. Has remote-controlled automatic timer. Weight under 45 lbs.

CURTISS-WRIGHT GAMMA CAMERAS

	MODEL	CURIE STRENGTH	FOCAL SPOT SIZE
10—1	External Pipe Line	25 Curies Ir 192	.062 x .176"
10—2	Gen'l Purpose Camera	25 Curies Ir 192	.062 x .176"
10—4	Shop Camera	2 Curies Co 60	.125 x .125"
10—4A	Shop Camera	10 Curies Co 60	.125 x .250"
10—5A	Puff Camera	30 Curies Ir 192	.062 x .176"
10—5B	Puff Camera	100 Curies Ir 192	.187 x .280"
10—5C	Puff Camera	2 Curies Co 60	.125 x .125"
10—5D	Puff Camera	10 Curies Co 60	.125 x .250"

		BEST RANGE	
MODEL	HEAD WEIGHT	STEEL & BRONZE	LIGHT METALS (AL. & MAG.)
10—1	43 lbs.	⅜"-2½"	1"-2½"
10—2	45 lbs.	⅜"-2½"	1"-2½"
10—4	340 lbs.	¾"-8"	over 3½"
10—4A	850 lbs.	¾"-8"	over 3½"
10—5A	44 lbs.	⅜"-2½"	1"-2½"
10—5B	180 lbs.	⅜"-2½"	1"-2½"
10—5C	390 lbs.	¾"-8"	over 3½"
10—5D	900 lbs.	¾"-8"	over 3½"

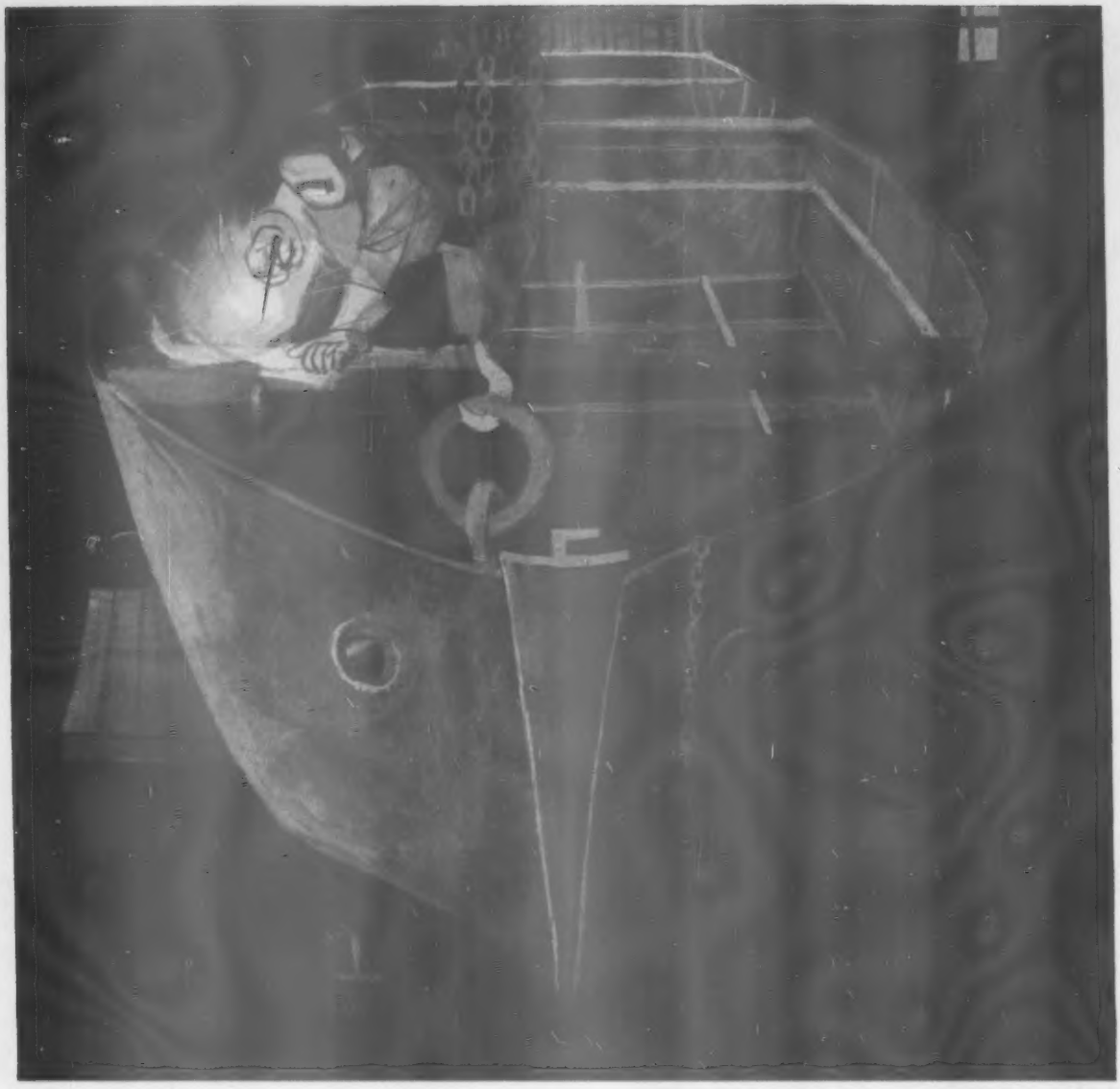
With the new Curtiss-Wright Puff Camera, pressure vessels, castings, ship holds, nuclear installations, pipe lines and other critical structures can be radiographed with high strength sources from remote locations with complete operator safety.

The flexible steel reinforced tubing and small source head can be introduced through small openings and can be coiled up like a garden hose if necessary. The source can be exposed from a distance of 100 feet in less than 2 seconds at the press of a button. The rapid source action reduces operator exposures and eliminates costly film fogging. Works from plant air supply or nitrogen cylinder. Write for complete technical details.

PRINCETON DIVISION

CURTISS-WRIGHT

CORPORATION • PRINCETON, N. J.



First Order for All-Welded Aluminum Hulls Convinces Boat Builder:

"ALUMINUM IS EASY TO WELD"

"Only four months for designing and building 72 all-welded aluminum-hulled boats for the purse seining fishing fleet left us no time for welding mistakes," says Mr. Donald C. Hankin of RTC Shipbuilding Corp., Camden, N. J. "These boats take tremendous punishment from pounding seas, rugged weather and from the drag of tons of menhaden fish against the hulls. This means that every weld has to be perfect.

"Our only previous experience with aluminum welding had been a trial order for two boats of the same type. Our customer was so impressed with their performance that he immediately ordered a whole fleet.

"Prior to building these test boats, three of our welders had received training at Alcoa's New Kensington job shop. Now this really paid off. We found that aluminum could actually be welded at a faster rate than steel, and with relative freedom from warping and distortion. Aluminum's lighter weight eased handling problems and speeded assembly. As a result, the order was completed on schedule and the customer reports no trouble with the aluminum hulls."

This is only one example of the many exciting possibilities in welding, brazing and soldering Alcoa® Aluminum and its alloys. Alcoa's research in alloys, welding techniques and joining methods can help you all the way from design to production. For more information, contact your Alcoa sales office. For welding materials, call your local Alcoa Distributor listed at the right. And for booklets and films that show how easy it is to weld, braze and solder aluminum, write Aluminum Company of America, 1761-C Alcoa Bldg., Pittsburgh 19, Pa.

Your Guide to the Best in Aluminum Value

ALCOA ALUMINUM

For Exciting Drama Watch "Alcoa Theatre," Alternate Mondays, NBC-TV, and "Alcoa Presents," Every Tuesday, ABC-TV

Want technical help in welding, brazing or soldering aluminum? Contact your Alcoa sales office, listed under "Aluminum" in the Yellow Pages of your phone book.

For immediate delivery of Alcoa welding products, call your Alcoa outlet listed below. He carries a complete range of alloys and sizes.

ALABAMA
Birmingham
Hinkle Supply Co.

CALIFORNIA
Los Angeles
Ducommun Metals & Supply Co.
Pacific Metals Company, Ltd.
San Francisco
Pacific Metals Company, Ltd.

COLORADO
Denver
Metal Goods Corp.

CONNECTICUT
Milford
Edgcomb Steel of New England, Inc.
Windsor
Whitehead Metals Inc.

FLORIDA
Jacksonville
The J. M. Tull Metal & Supply Co., Inc.
Miami
The J. M. Tull Metal & Supply Co., Inc.
Tampa
The J. M. Tull Metal & Supply Co., Inc.

GEORGIA
Atlanta
The J. M. Tull Metal & Supply Co., Inc.
Southern Oxygen Co.

ILLINOIS
Chicago
Machinery & Welder Corp.
Steel Sales Corp.

KANSAS
Wichita
Metal Goods Corp.

KENTUCKY
Louisville
Williams and Co., Inc.

LOUISIANA
New Orleans
Metal Goods Corp.

MARYLAND
Baltimore
Southern Oxygen Co.
Whitehead Metals Inc.
Bladensburg
Southern Oxygen Co.

MASSACHUSETTS
Cambridge
Whitehead Metals Inc.

MICHIGAN
Detroit
Steel Sales Corp.

MISSOURI
Kansas City
Metal Goods Corp.
St. Louis
Metal Goods Corp.
Steel Sales Corp.

NEW HAMPSHIRE
Nashua
Edgcomb Steel of New England, Inc.

NEW JERSEY
Harrison
Whitehead Metals Inc.

NEW YORK
Buffalo
Whitehead Metals Inc.
New York
Whitehead Metals Inc.
Syracuse
Brace-Mueller-Huntley, Inc.
Whitehead Metals Inc.

NORTH CAROLINA
Greensboro
Southern Oxygen Co.

OHIO
Cincinnati
Williams and Co., Inc.
Cleveland
A. M. Castle & Co.
Williams and Co., Inc.
Columbus
Williams and Co., Inc.
Toledo
Williams and Co., Inc.

OKLAHOMA
Tulsa
Metal Goods Corp.

OREGON
Portland
Pacific Metal Co.
J. E. Haseltine & Co.

PENNSYLVANIA
Philadelphia
Edgcomb Steel Co.
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Whitehead Metals Inc.
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York
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TENNESSEE
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Beaumont
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Big Three Welding Equip. Co.
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UTAH
Salt Lake City
Pacific Metals Company, Ltd.

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Norfolk
Southern Oxygen Co.
Richmond
Southern Oxygen Co.

WASHINGTON
Seattle
Pacific Metal Co.
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WISCONSIN
Milwaukee
Machinery & Welder Corp.
Steel Sales Corp.

ALUMINUM panel used in truss construction. Truss bridge is designed to hold 60-ton tank on a 90-ft span (See WELDING ENGINEER, October, p. 99).

Army testing all-welded aluminum bridge trusses

ALL-WELDED ALUMINUM truss panels for military tactical bridges, designed to support a 60-ton tank on a 90-ft span, are being extensively tested at the U. S. Army Engineer Research and Development Laboratories, Fort Belvoir, Va.

The trusses were fabricated by Aluminum Co. of America, Pittsburgh, from a new non-heat-treatable, weldable aluminum alloy, 5456-H321. The alloy has an ultimate tensile strength of 42,000 psi.

To speed construction and make bridges portable, the trusses were divided into lightweight, easily connected panels. They are 16 ft, 2 in. long, 7 ft, 7 in. high, and weigh 920 lb. Upper and lower chords are box sections, diagonal and vertical members are built-up flange sections.

Two reasons supported the choice of Mig welding over other processes for fabricating trusses. When using the new alloy the annealing effect at and near the weld reduces the strength imparted to the parent metals by cold-work hardening. This made it necessary to limit the heating effect and to choose joint locations subjected to non-critical stresses.

Three variables had to be considered when determining the width of the heat-affected zone on each side of the weld. Temper and thickness of parent metal, rate of welding and number of passes and geometry of joints were taken into account.

Mig welding was chosen because heat is concentrated at the proper point of fusion for a short time.

Mig's other advantage is that it allows little weld cracking. With the heat concentrated at a specific point for a short time, only a small area of metal around the weld has time to expand and contract.

Several steps were required to assemble each truss. First, all sub-assemblies were cleaned and tack-welded together. These members were then completely welded using fully automatic Mig welding. Completed panels were then assembled and manually welded into units. Further welding details are given in accompanying table.

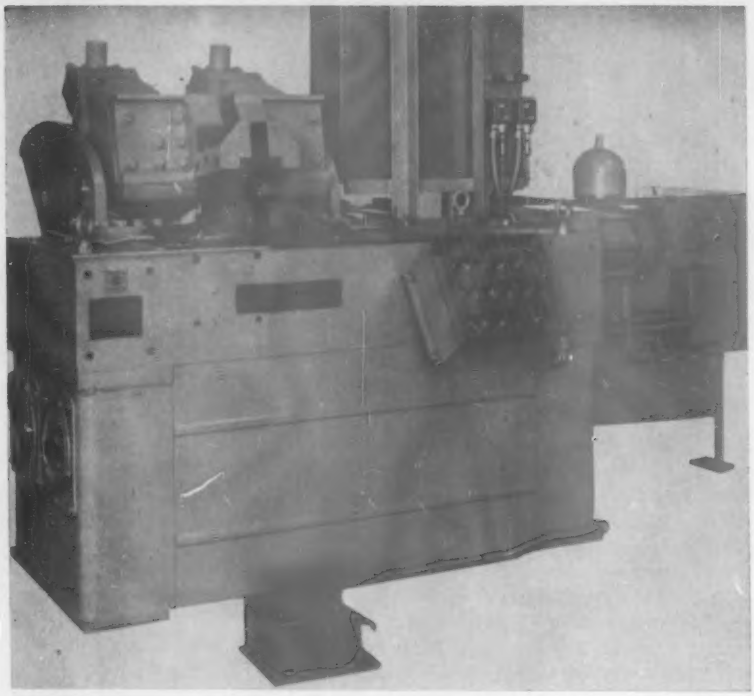
All major welds were made in the longitudinal direction of the structure. Thus, a cross section of an important element was not weakened by welding across its axis.

Jigs and fixtures were not used, as distortion problems were minor and the Army says serviceability of trusses was not affected.

Current tests at Fort Belvoir will continue until June of this year.

Mig	Fillet size	5556 electrode diameters	Argon flow (cfh)	Welding current (amp)	Arc volts	Weld speed (ipm)	No. of passes
Automatic	1/4"	3/32"	50	250	26	25	1
"	3/8	3/32	60	290	26	15	1
Manual	3/16	1/16	30	190	22	20	1
"	1/4	1/16	40	225	25	18	1
"	3/8	1/16	40	240	25	12	1

new products . . . use card on page 89



You can see many of these new products on exhibit at the American Welding Society's Welding Show to be held in Chicago's International Amphitheater, April 7 to 9.

Flash welders

AUTOMATIC 400 kva-F5 machine is for flash welding hot rolled steel rings 3/8-in. thick and up to 8 in. wide. Air operated clamps hold work. Hydraulic cylinder provides upset force of 38,000 lb. Unit includes an electrical control panel for controlling hydraulic unit, clamping, flashing, upset, etc. All controls are calibrated, simplifying duplication of setup. *Federal Machine & Welder Co.*

Circle No. 1

Machine carriage

TWIN fillet machine carriage allows automatic welding of stiffeners, flanges and other structural components from corner to corner. Units are available for submerged arc, Mig and other consumable welding processes. Unit includes dual automatic wire feeds, cartridge type electronic controls, two d-c 500 amp, 100% duty cycle, three phase welding machines enclosed in one console. Has speed range from 0 to 60 ipm. *L&B Welding Equipment, Inc.*

Circle No. 2

Surface clamp

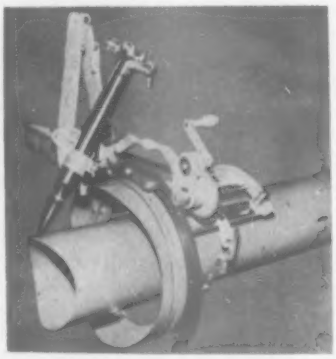
VERTICAL surface clamp, S-2833, has hook-spring-chain assembly for use on all company B, C, and D size molds. Mold supports itself and adjusts to various pipe sizes. *Erico Products Inc.*

Circle No. 3

Self-fluxing alloy

AMBRAZE 211 brazing alloy is self-fluxing on copper to copper joints. Joint brazed with 211 is said to be stronger than parent metal. Alloy can be used on copper, brass or bronze in maintenance, construction, air conditioning and heating work. Alloy's tensile strength is 40,000 psi, elongation is 20% in 2 in., melting point is 1,300 F. Comes in 1/16, 3/32, 1/8, 3/16 and 1/4 in. diameters. *American Brazing Alloys Co.*

Circle No. 4



Pipe cutting attachment

SHAPE cutter attachment to fit company's standard pipe cutting and beveling machines has been remodeled and designed to cut various shapes of pipe intersections automatically. Free-wheeling roller attachment that turns 360 deg has been added to Out-Of-Round attachment. Roller rides pipe surface, automatically making corrections for any imperfections. *H&M Pipe Cutting & Beveling Machine Co.*

Circle No. 5

Silver-bearing alloy

SILVER-BEARING brazing alloy with low melting temperature, high fluidity and electrical conductivity is EutecRod 1801-Super. Manufacturer says it has good wetting and thin flowing properties, flowing freely through long laps of copper, brass, bronze or dissimilar combinations. Alloy melts at 1,135 F. Joints have up to 80,000 psi tensile strength. *Eutectic Welding Alloys Corp.*

Circle No. 6

Aluminum wire

COMPANY has an aluminum clad copper wire designed for use in production of high temperature magnet wire and many electrical conductor applications in aircraft, missiles and other high speed industrial equipment. Aluminum surface, which is approximately 40% of cross-sectional area, can be anodized for insulation. *Sylvania Electric Products Inc.*

Circle No. 7

Temperature indicators

TEMPIL Pellets for 525 F and 650 F fill gaps in standard series ranging from 100 F to 2,700 F. Pellets 525 F are in tool steel tempering range and in thermo-setting level of some epoxy resins. Pellets 650 F can also be used with tool steels as well as in heat treating non-ferrous metals. *Tempil Corp.*

Circle No. 8

Thawing attachment

SAF-T-THAW is a device that prevents gasoline engine driven arc welders from burning out because of heavy overloads for too long a time. Gasoline engine driven arc welder rated as low as 250 amp can be used safely with attachment to thaw frozen water pipes, says manufacturer. Unit is connected in welder circuit and can be located at or away from welder. Meter shows current passing through cables and a standard lag fuse protects welder against overload. *Hobart Bros. Co.*

Circle No. 9

Portable stud-welder

GRAHAM Super-Six portable stud welder welds insulation pins or other studs up to ¼-in. in diameter to light gage aluminum as well as other metals without distorting or discoloring. Unit welds without inert gas, flux, ceramic ferrules or compressed air connection. It operates from any standard 115 volt a-c outlet. Machine can also weld steel insulation pins or studs to a steel work piece. Architects, construction contractors, sheet metal fabricators and ship builders are said to be able to put machine to good use. *Graham Mfg. Corp.*

Circle No. 10

Photo courtesy Chicago Bridge & Iron Co.

NATIONAL WELDED PRODUCTS MONTH
APRIL

Visit The
AWS WELDING SHOW
Booth 530

When there's no margin for error...specify

ATOM·ARC ALLOYS

FOR WELDING

Low Alloy or High Strength Steels

Photo courtesy Baldwin-Lima-Hamilton Corp.

With continually increasing fabrication costs, you can't afford a *margin for error*. Successful fabricators specify the inherent qualities of all position iron powder low hydrogen Atom Arc electrodes to reduce the unnecessary rework that chews up profits and delays jobs.

Inspection by X-ray is a requirement for most fabrications involving low alloy or high tensile steels. There is an Atom Arc alloy with the right physical properties and chemistry for welding most low alloy or high tensile steels. An electrode that deposits X-ray sound weld metal, increases the efficiency of your welding operation and lowers your costs. For complete details write for the "Handbook for Welding Low Alloy High Tensile Steels," Alloy Rods Company, Dept. 02, P. O. Box 1828, York, Pennsylvania.

Atom Arc 7018 Mo
AWS-E7018-A1
Atom Arc 8018 N
AWS-E8018-C2
Atom Arc 8018 CM
AWS-E8018-B2
Atom Arc 9018 CM
AWS-E9018-B3
Atom Arc 10018 MM
AWS-E10018-D2
Atom Arc 12018 NMV
AWS-E12018-G
Atom Arc T
AWS-E11018-G

Alloy Rods Company

YORK, PENNSYLVANIA ■ EL SEGUNDO, CALIFORNIA

Alloy Rods Co.

QUALITY WELDING ELECTRODES FOR
Stainless Steel
Low Alloy Steels
Cast Iron
Tool Steel
Bronzes & Dissimilar Metals
Hard Surfacing Electrodes & Wires

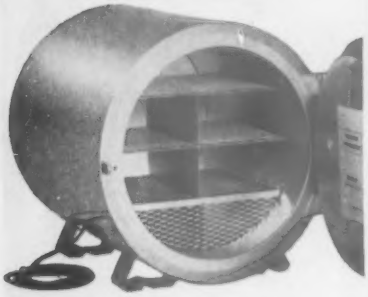
NO FINER ELECTRODES MADE . . . ANYWHERE

YOU GOTTA KEEP 'EM DRY!

Moisture "messes up" electrodes, too, cuts welding profits.

End costly reworks by drying rods in

DryRod® OVEN



Mineral coated electrodes are *thirsty*. The instant you unpack them they start soaking up moisture . . within 2 hours often as much as 13 times US allowable specifications. Moist rods cause porosity, under-bead cracking, rough welds, etc. Rod scrap runs high Production slows down. Reworks eat up profits.

Storing rods in DRY-ROD OVEN prevents such losses, insures faster, finer workmanship at less cost.

Write for new literature on latest rod-drying methods, "Dry Rod as Standard Welding Equipment."

PHOENIX PRODUCTS COMPANY

4727 N. 27th St. • Milwaukee 9, Wis.

Welding, cutting unit

SUPER-RANGE is a complete package welding and cutting outfit able to handle welding, cutting, heating, brazing and soldering jobs encountered in shop work. Outfit includes two single-stage regulators, welding torch, cutting attachment, three welding torch nozzles, cutting tip, dual welding hose, spark lighter, goggles and wrench. Unit can weld metal ¼-in. thick and cut metal up to 1 in. thick. *Victor Equipment Co.*

Circle No. 11

Utility trucks

JOB-planned utility truck bodies are specially designed for welding industry. Removable shelf and tray dividers allow each truck driver to vary vehicle's interior arrangement to suit daily requirements. Dividers and bins are standard equipment on all models. Bodies include stainless steel hinge pins, cross sills at critical stress points and safety-tred plate floors. *Reading Body Works Inc.*

Circle No. 12

Engineering kit

EXPERIMENTAL kit contains three silver brazing pastes for use in testing production silver brazing applications and for determination of cost reduction and increased production potential. Pastes can be automatically applied. Kit allows production engineers to evaluate process as production tool, says manufacturer. Included are three basically different types of brazing pastes with same standard 45% silver alloy. *Fusion Engineering.*

Circle No. 13

Sealing compound

LED-PLATE Anti-SEIZE sealing compound, No. 250 F with filler added, is said to stop spiral leaks from large diameter threads and coarse fittings, and in welded flanges that have become oval or distorted. Material can be used at —350 F to 2,987 F and hydraulic pressures to 50,000 psi. *Armite Laboratories.*

Circle No. 14

Packaged gloves

ALL of company's gloves and mittens now come in flip-open top clear plastic bags so gloves can be easily removed and replaced. This includes new economy glove 916 and deerskin glove 914. *John Tillman & Co.*

Circle No. 15

Shield them with economical barriers of J-M ALUMINIZED Asbestos Cloth

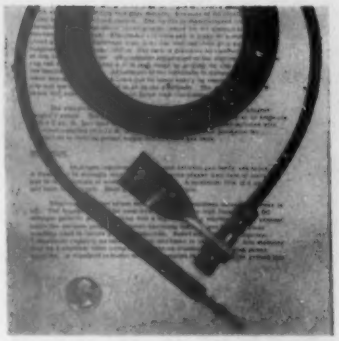
Radiant heat is a major cause of discomfort and fatigue that reduces efficiency and causes accidents. Economical new J-M *Aluminized* Asbestos Cloth reflects 90% of all radiant heat . . . helps maintain high production and good safety practices.

This new J-M material is a rigidly tested combination of aluminum and Asbestos. It retains a great degree of strength at temperatures up to 1400°F —over long periods of time—and can be used for curtains, shields, blankets, hoods and covers to protect workers from flame as well as radiant heat.

For further data, write Johns-Manville, Box 14, New York 16, N. Y. Ask for Brochure TX-2A.

PORTABLE SHIELDS for emergency jobs near heat or flame can also be made with this J-M *Aluminized* Asbestos Cloth.

JOHNS-MANVILLE



Miniature Tig torch

ARGOPEN Model B is an inert gas, air cooled arc welding torch for precision welding on light gage metals. It has mechanical adjustment of electrode beyond cup end, continuous 20 amp rating, see-thru pyrex cup, 12 ft power cable hose with cable adaptor, ½-in. machine connection and ¼-in. female gas hose connection. Torch is insulated, grips any diameter electrode from 0.005 to 0.045-in., and receives standard 3-in. long electrodes. Unit has welded two sections of 0.016-in. aluminum. *Argopen Co.*

Circle No. 20

Cutting torch

AIRCO series 2000 injection-type hand cutting torches, for use with propane and natural gas, has a special oxygen valve which simplifies hole piercing, rivet washing and stay bolt cutting. Mixer housing is fed by two tubes, one for fuel gas and one for preheat oxygen. Inlet connections accommodate 1/4, 5/16 or 3/8-in hose. *Air Reduction Sales Co.*

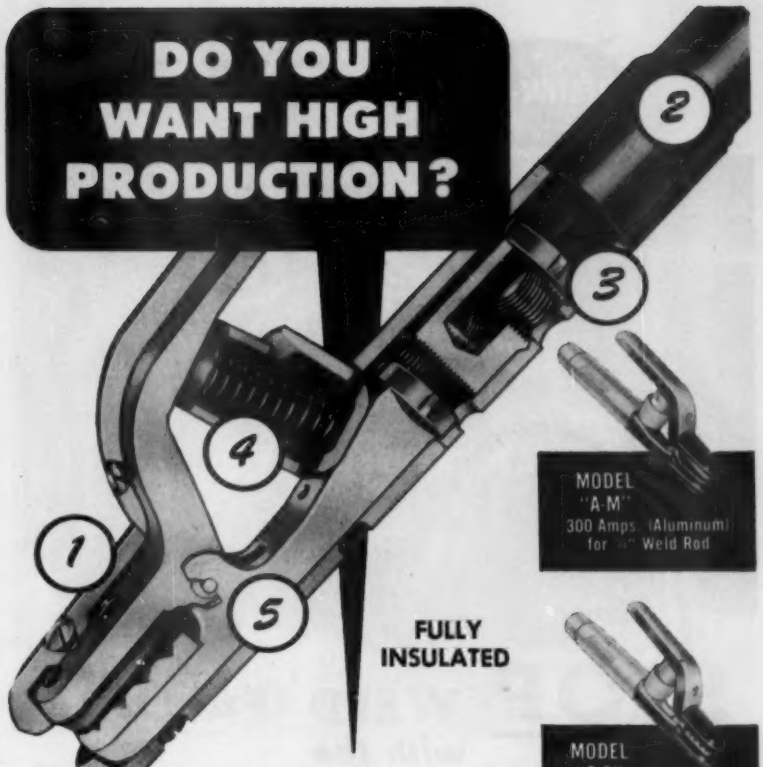
Circle No. 21

Turning roll

MODEL H-3000 heavy duty controlled torque turning roll is powered by a 5 hp variable speed drive through a torque coupling. Vessels cannot slip and injure operating personnel as control device is placed ahead of final cone drive reducers. Supporting wheels are sandwiched rubber and steel mounted on pillow blocks. Maintenance cost is low since gear boxes do not have to be disassembled to replace tires. Unit has a 300,000 lb. capacity. *Webb Corp., Reed Equipment Div.*

Circle No. 22

DO YOU WANT HIGH PRODUCTION?



MODEL "A-M" 300 Amps. (Aluminum) for ⅛" Weld Rod

MODEL "C-S" 250 Amps. (Copper Alloy) for ⅛" Weld Rod

MODEL "C-M" 300 Amps. (Copper Alloy) for ⅛" Weld Rod

MODEL "C-L" 500 Amps. (Copper Alloy) for ⅛" Weld Rod

SuperGrip®

PRODUCES

more work, safer, easier!

SuperGrip Electrode Holders are designed to make easy all operations in welding... from attaching Holder to cable on through to depositing weld metal in any welding position!

YOU GET MORE out of *Super-Grip* for these reasons:

1 RUGGED, LONG WEARING interchangeable jaw insulators are easily replaced *QUICKLY*. Jaw pads of the aluminum Model "A-M" are easily replaced.

2 EXCLUSIVE NECKED-DOWN HANDLE cuts "cable fatigue" and "down time" by reducing cable play at handle end and close to cable connection... prevents fraying and fatigue of wire strands... makes *SuperGrip* firmer, handier working tool.

3 BALL POINT SET SCREW of "man-size" diameter really *grips* cable tightly... can be tightened without removing handle... provides maximum current-conducting cross section... minimizes re-connections to save time.

4 POWERFUL COMPRESSION of enclosed spring puts extra "bite" in *SuperGrip* jaws... minimizes electrode waste or loss.

5 PERMANENT PIVOT BUSHING in tongue of trigger assures alignment, minimizes wear and increases service life of the Model "A-M" Aluminum Holder. Positive grip helps produce more... better work.

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ELECTRIC-ARC INC.

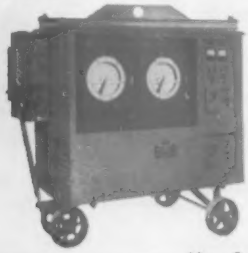
One of a Series on Applications of Electric Arc's Smith-Dolan Units — Today's Most Versatile Heat-Treating Tools.

STOP WELD FAILURE with the SMITH-DOLAN SYSTEM of Low-Frequency Induction Heating

Here is the versatile heat-treating tool you need for producing sound welds easily and economically in carbo-alloy and other types of steel pipe . . . here is precision control of heating cycle when pre-heating and stress relieving — uniform, through-and-through heating of solid sections up to two feet thick and more — pushbutton operation — complete portability for on-the-job heat treating anywhere.

Many Money-Saving Applications — The Smith-Dolan System simplifies and upgrades work quality in numerous applications ranging from welding to forming and annealing. Units are available for 60 cycle heating in capacities ranging from 10 to 150 KVA . . . for 400 cycle heating . . . resistance heating. Pre-engineered with complete instrumentation, accessories.

"On Trial" Installations on Rental Basis — Prove the many Smith-Dolan advantages in your own plant without capital investment. Write, wire or phone.



Electronic recording gives permanent charts of heat run on this standard Smith-Dolan model. Coils permit work at 50 feet or more from unit. Eye hooks provide for easy handling by crane. Products ranging from a fraction of an inch to 10 feet in diameter can be heat treated on the job.

New Brochure — Send today for your copy of "Smith-Dolan System of Low-Frequency Induction Heating."

Electric Arc, inc.

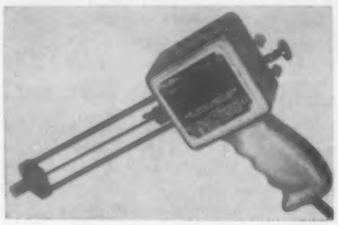
152-3 JELLIFF AVENUE, NEWARK 8, N. J. Bigelow 3-3211

Representatives in Principal Cities

Arc welder

MODEL 212-B light industrial a-c arc welder has a 5½ hp, 220 volt single phase motor that requires a 60 amp fuse for 20 to 50 amp input. Model uses welding electrodes 1/16, 3/32, 1/8, 5/32 and 3/16 in. in diameter. A 440 volt model can be ordered. Model includes single control wheel, on-off switch and dial indicator. Maximum on low side scale is 175 amp with 80 OCV designed to stabilize arc so stainless steel, low hydrogen and E6011 electrodes can be used. High side amp scale has maximum 212 amp with 55 OCV for regular welding. *Birdsell Mfg. Co.*

Circle No. 23



Spot gun

BREN-WELD Arc-Spot welding gun Model G can spot weld sheet metal from one side without a back up electrode. Gun employs an automatic time control, and has no triggers or levers to operate. It is able to weld galvanized as well as mild steel in duct work, auto body repair, etc. *Brennen, Bucci & Weber Inc.*

Circle No. 24

Tank drain

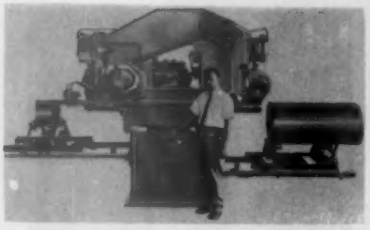
HEAVY-duty automatic tank drain is said to be answer to air-compressor water nuisance. Electronic drain, attached to or near the air compressor, automatically purges water accumulation. This prolongs tank life, deters rust, eliminates odors and prevents washing off of lubricants. *Squire-Cogswell Co.*

Circle No. 25

Welding clamp

NEW Kant-Twist clamp with 4½-in. deep throat has 3 in. reach. Hand-tightening firmly holds clamp in place while working, says manufacturer. *Saxton Mfg. Co.*

Circle No. 26



Weld roller

HYDRAULICALLY operated longitudinal-circumferential weld-roller, No. 2-LC, flattens welds to thickness of parent metal. Dual purpose machine has 25 ton force on either end. Longitudinal end of machine rolls welds on pieces ranging from 5¼ to 36 in. in diameter. One pass rolling on work up to 14½ in. long with a diameter of 5¼ in., and up to 18½ in. long on pieces with greater than 8 in. ID can be done. Circumferential end handles pieces with a 2 to 18½ in. width from edge to circumferential weld. Rolling speed at either end is 60 ft per minute. *Grotnes Machine Works Inc.*

Circle No. 27

Bronze alloy

LOW FUMING bronze brazing alloy, for fusion welding and surface buildup, comes in bare and flux coated forms. Low melt-in point, 1,575 F, allows free flow and produces a strong weld, says manufacturer. Bare electrodes come in 1/16, 3/32, 1/8, 5/32, 3/16, 1/4 and 3/8-in sizes. Coated electrodes come in 3/32, 1/8, 3/16 and 1/4-in. sizes. *Dalweld Co., Inc.*

Circle No. 28

Molding compound

PLASTIC steel, when mixed with new Devcon Flex, will stand up to sledge-hammer pounding without breaking. Combination has been used to repair an 18-in. cylinder crack in an air hammer, in repairing an oil tanker pump and as vibration cushioning under machinery. Combination, once hard, can be drilled, ground or otherwise machined. It can bond iron, steel, wood, aluminum, glass and brass to themselves or each other. *Devcon Corp.*

Circle No. 29

Plastic goggles

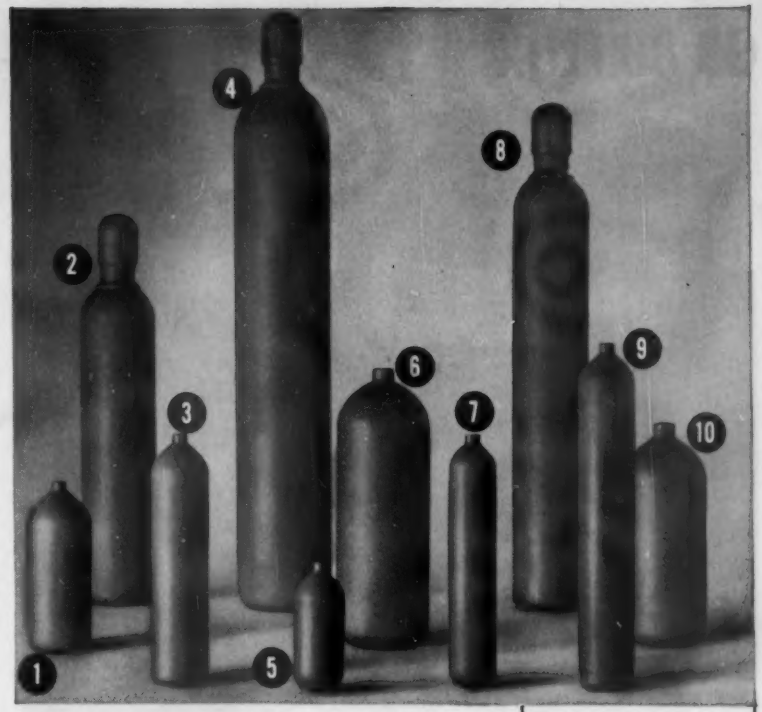
WRAP-Around plastic goggle G 537 is lightweight and gives all-around eye protection. Extra large, one-piece acetate lens is designed with wide shields which may be tucked inside temple frame. Can be worn over prescription glasses. *Pulmosan Safety Equipment Corp.*

Circle No. 30

Contact-pressure adhesive

MARASET resin 532 is high-strength adhesive requiring only contact pressure for durable bond that will not delaminate, says manufacturer. Designed to join metals, the resin can also be used to join other materials. For general requirements it is blended with a hardener and cured at room temperature overnight, or at 200 F for one hour. *Marblette Corp.*

Circle No. 31



Choose high-pressure gas cylinders from the HACKNEY "Family"

Shown here are ten popular Hackney high-pressure gas cylinders for industrial and medical services.

They are popular because they more than pay their way through long, maintenance-free service.

Lightweight, without sacrificing safety, strength or durability, Hackney deep drawn cylinders:

- **save money on shipping costs**
- **reduce handling costs**
- **cut maintenance costs—smooth surfaces clean easily, paint quickly**
- **provide full capacity—no need for complaints**
- **require minimum storage space per cylinder**
- **earn customer good will—attractive appearance in doctors' offices, clinics, hospitals, etc.**
- **permit you to serve *all* customers with cylinders of the size they need**
- **exceed all ICC specifications**

1. 5-lb. CO_2 5¼" x 13⅞"
2. 80 cu. ft. oxygen 6⅛" x 32½"
3. "D" Medical 3⅛" x 16¾"
4. 250 cu. ft. oxygen 8⅝" x 51"
5. "A" Medical 3⅛" x 7⅞"
6. 20-lb. CO_2 7.45" x 23¼"
7. 11 cu. ft. oxygen 3¾" x 18⅞"
8. 110 cu. ft. oxygen 6⅛" x 43"
9. "E" Medical 3¹⁵⁄₁₆" x 25¾"
10. 10-lb. CO_2 6½" x 18⅛"

SEND FOR NEW BULLETIN. Gives complete facts about Hackney manufacturing features, range of capacities and sizes, ICC specifications, and other helpful information. Write:

Pressed Steel Tank Company

Manufacturer of Hackney Products Since 1902

1456 South 66th Street, Milwaukee 14, Wisconsin

Branch offices in principal cities

CONTAINERS AND PRESSURE VESSELS FOR GASES, LIQUIDS AND SOLIDS

GB 88 FLUX .. available in 3 oz., ½ lb., 1 lb., 5 lb. jars and 25 lb. drums to suit your needs

Use GB 88 Flux, the flux of proven dependability and note the improvement in the quality of your Silver Brazing. GB 88 is fully active to 1650°F.

Low glare and low fuming characteristics insure operator comfort and quality results. It is stable in use as well as in storage and was developed for Silver Brazing of STEEL, BRASS, COPPER, STAINLESS STEEL, MONEL, NICKEL, INCONEL, CHROME ALLOYS, SILVER and GOLD.

For best results team up GB 88 Flux with GB Silver Brazing Alloy in the form or size you require: random coils (all diameters), strip, straight lengths, pre-formed rings and special shapes. Prompt service on all inquiries.

90th ANNIVERSARY

Goldsmith Bros.
SMELTING & REFINING CO.

111 N. Wabash Ave., Chicago 2, Ill. • 74 W. 46th St., New York 36, N. Y.
OAKLAND

Write to us on your company letterhead for a FREE working sample

Propane cylinder

PROPANE cylinder P-6, with 6-lb capacity, is designed for use with variety of standard and special valves for any type of propane service. Cylinder can be used with all LP-gas soldering, heating and brazing equipment, and can be adapted for trailer use. P-6 can be used for liquid or vapor service in vertical or horizontal position. *Linde Co.*

Circle No. 32

Grinding wheel

ADDITION to line of Flexcore expanding-type grinding wheels is Model 004, which is 4-in. in diameter and comes in various widths. New core design is made of extruded aluminum. Manufacturer says this design facilitates the custom sizing of individual wheels to meet specific use requirements. Flexcore is claimed to retain the abrasive band under all operating conditions without using any bonding material. *Nu-Matic Grinders Inc.*

Circle No. 33

Solder-type alloy

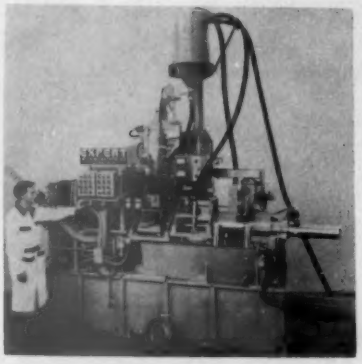
EUTECROD 1909 is a low melting solder-type alloy that can be used without separate flux on magnesium. Alloy begins melting at 350 F, well below transformation temperature of heat treated magnesium alloys. Can be used for building-up, filling and sealing castings, wrought forms and extruded shapes, and can join aluminum to itself or other metals if used with proper Eutector Flux. *Eutectic Welding Alloys Corp.*

Circle No. 34

Puff camera

PRESSURE vessels, ship holds, nuclear installations, pipe lines and other critical structures can be radiographed with high strength sources from remote locations with puff camera. Flexible steel reinforced tubing and source head can be introduced through small openings and coiled like hose if necessary. Source can be exposed from distance of 100 ft. in less than 2 seconds by pressing button. Rapid source action reduces operator exposures and eliminates film fogging, says manufacturer. Works from plant air supply or nitrogen cylinder. *Curtiss-Wright Corp., Princeton Div.*

Circle No. 35



Automated welder

FIVE-STATION in-line transfer, automated welding machine press assembles disc and hub parts and welds them in one continuous operation. Transmission parts are produced at rate of 120 per hour. Parts are transferred from station to station by a 10-ft longitudinally reciprocating transfer bar. Machine's modular construction permits station addition, removal or interchange. When welding, assembly is placed in rotating holding fixture while slide mounted welding head welds hub to disc. Flux is automatically gravity-fed from overhead hopper. Rotating vacuum nozzle returns unfused flux to hopper, slag is chipped from weld and part is automatically ejected. *Expert Welding Machine Div.*

Circle No. 36

Brushless generators

A-C generators are designed for tractor-drive farm emergency application. Sizes are 7,500 and 15,000 watt, 115/230 volt. Generators are brushless and include a heavy duty control box with field rheostat, voltmeter, frequency meter and automatic voltage regulator. Units can be adapted to belt and power take-off drive. PTO models can be supplied on a trailer for portability. *Katolight Corp.*

Circle No. 37

Nibbler attachment

NIBBLER attachment to fit any Fenway portable nibbler makes circles from limit of nibbler's radius to unlimited diameters. Attachment has straight edge guide, and is designed for prototype work in model shop or development lab or for maintenance work. *Pensco Products.*

Circle No. 38

Ranite Hardsurfacing Rods are So Easy to Use they've earned the title, "The Weldor's Rod"

NINE ADVANTAGES combine to make Ranite metallic-coated rods easiest to use:

1. Operation is equally good on AC and DC machines.
2. Application is practical in *all positions*—including vertical and overhead!
3. Arc is very quiet and stable.
4. Loss from splatter is eliminated.
5. There is no slag to remove.
6. Clear welding vision is maintained.
7. Arc can be re-struck instantly, if broken, because of metallic coating.
8. Rapid deposition rate gets the work done fast.
9. Latitude is very broad—just five Ranite rods—A, BX, C, D and No. 4—handle the *great majority* of all jobs—makes selection quick and easy! (Other Ranite rods available to meet every requirement.)

GET FREE Ranite Select-O-Graph Guide—shirt pocket size—shows best rod to meet any wear condition. Ask your Ranite representative or write direct.

Originators and pioneers of metallic-coated rods—since 1938.

Ranite
WELDORS' NO. 1 CHOICE FOR HARDSURFACING

RANKIN MANUFACTURING CO.
616 So. Marengo Ave., P. O. Box 631
Alhambra, Calif.

20,000-gallon capacities are said to almost double those of conventional cars, are domeless, equipped with safety platforms and come in insulated or uninsulated models. Trucks and all underframe parts are standard.

To build the large cars, steel was rolled into barrel-shaped sections on a pinch-type, drop-end roll. The sections were butt-welded into tanks using automatic submerged-arc welding. All welds were stress relieved and X-rayed.

The large car is 52 ft, 2 in. long, weighs 69,700 lb, and has a maximum lading weight of 9 lb per gallon. The smaller car is 43 ft, 6 in. long, weighs 59,050 lb and has a 11.9 per gallon lading weight. Both cars are on 100-ton-rated trucks, and have a 14 ft, 10 in. clearance.

Aluminum refrigerator cars used by Canadian railroad

Aluminum refrigerator cars, with welded floors and underframes, are being used by Canadian National Railways. Said to be the world's first all-aluminum refrigerator cars, they are 22.5% lighter than previous ones, saving 14,200 lb of weight.

Composite rivet and weld construction was used on the underframe, but the aluminum floors are all-welded.

Aluminum Co. of Canada, Ltd., built the cars after helping the railway design them. Five cars are now undergoing extensive testing to determine their strength, durability and road performance.

Codes increase use of welding Standards Engineers told

Welding codes have helped increase the use of welding in Canada, R. M. Gooderham, director of the Canadian Welding Bureau, told registrants at the recent annual meeting of the Standards Engineers Society in Philadelphia.

The bureau, a division of the Canadian Standards Association, administers welding codes, tests operators and equipment and certifies both if they meet welding standards.

Vernon L. Cox, manager of the Laboratories Dept., Switchgear and Control Div., General Electric Co., Philadelphia, was among four people who received Society fellowships. Awards were given for "outstanding service to standardization."

"Standardization—a must for the space age" was the theme of the meeting attended by standards engineers from companies, associations, societies and government organizations in the United States and Canda.

Sonic energy report available

"How to appraise sonic energy cleaning," a report published by the Pioneer-Central division of Bendix Aviation Corp., Davenport, Ia., relates sonic energy applications in industry and explains how it can be applied efficiently for cost reduction and product improvement.

A copy can be obtained by writing to Sonic Energy, Pioneer-Central Div., Bendix Aviation Corp., Hickory Road, Davenport. Use a company letterhead when writing.

All-State conducts four-day sales meeting

ALL-STATE Welding Alloys Co., Inc. recently held a four-day sales meeting for regional sales managers at its White Plains, N. Y., headquarters. Included during meeting was practice welding with company's new hardfacing electrode, films and discussion of new welding techniques. Seated left to right, C. Oleson, purchasing agent, R. Mandel, vice president, T. Nast, president, C. Brown, divisional sales supervisor, S. Mandel, director of market development. Second row, L. Wade, general sales manager and regional sales managers H. Tucker, A. Martin, C. Bastion, M. Stavig and J. Poulson. Third row, H. Peacor, divisional sales supervisor, regional managers T. Turnbow, R. Nordin, J. Ehrhardt, S. Smith, manager of Canadian subsidiary and W. Hawker, N. Y. district engineer.

CRANE removes 17-ton unit from one of six flatcars loaded with oxygen and nitrogen generating equipment for Linde Co.'s Pittsburg, Calif., plant, now under construction.

Gas production equipment arrives at Linde site

Six flatcars of oxygen and nitrogen generating equipment weighing 120 tons recently arrived at the construction site of Linde Co.'s new gas producing plant near Pittsburg, Calif.

The equipment, designed and fabricated at Linde's Tonawanda, N. Y., factory, includes liquefiers, compressors and heat exchangers. It is capable of producing 190 tons of liquid oxygen and nitrogen daily.

First section of the new plant is scheduled to begin operation in June, with a capacity of 115 million cu ft of liquid gases a month. It will run continuously under the direction of Norman R. Harris, operating superintendent.

Solar awarded honeycomb contract

Solar Aircraft Co., San Diego, has been awarded a contract totaling nearly $1,000,000 for continuing manufacture of all-metal honeycomb sandwich components for the B-58 jet bomber produced by Convair Div. of General Dynamics at its Fort Worth, Tex., plant.

The order calls for the manufacture of 16 different brazed honeycomb sections for each aircraft set.

Aluminum useful in power construction

George Barney, electrical engineer with Stone & Webster Engineering Corp., New York City, says development of effective welding methods which assure good welded joints has been a main factor in expanding the use of aluminum in construction of rigid and strain-type buses on electric generator stations.

L&B Welding Equipment to make jigs, fixtures

L&B Welding Equipment Inc., Berkeley, Calif., formerly Leader Welding & Mfg., is about to introduce electronic welding controls with maximum quality controlled features, a complete line of double ended positioners and specialty jigs and fixtures, according to Cliff Leader, president.

Though primarily in the hardfacing equipment business, the company's research and development department produced the new items.

Chicago Steel Tank now Solar Chicago

The Chicago Steel Tank Co., a division of U. S. Industries Inc., New York City, has been renamed Solar Chicago.

Linde to double Gary oxygen capacity

Linde Co., New York City, will construct this year another 94,000,000-cu-ft-per-month oxygen plant at U. S. Steel Corp.'s Gary steel works.

The new plant will also produce 256,000,000 cu ft per month of high purity nitrogen for use at USS's sheet and tin mill. The original plant, which began production last June, will be modified to produce the same amount of nitrogen.

Most of the oxygen produced at the two plants will be used in open-hearth furnace steelmaking, the remainder will be used for scarfing, scrap-cutting and general maintenance.

Linde will build and operate the new plant on property leased from US Steel.

SELLSTROM Mfg. Co., Palatine, Ill., has expanded its industrial prescription safety glasses laboratory. Expansion will supply tempered impact resistant safety glasses ground to individual prescription. Sellstrom's nationwide franchised distributing organization will make prescription glasses available to persons in all areas.

Eastern Precision buys Epsco delay line business

Epsco Inc., Boston, has sold its delay line and pulse transformer business to the Eastern Precision Resistor Co., Brooklyn. The sale was made so Epsco's Components Div. could concentrate on the digital field.

Included in the transaction is the transfer of machinery, equipment and engineering and manufacturing processes.

Airline

FEATURES A BROAD VARIETY OF BACK-UP MANDRELS FOR AIRLINE LONGITUDINAL WELDING POSITIONERS

MODEL 1064B pre-heated back-up mandrel for use with Airline Model LW 10,000 Series Longitudinal Welding Positioner. Equipped with four "quick-clamp" back-up bar receiving grooves 90° apart. One heating oil inlet and outlet. Each back-up insert receiving groove is equipped with gas back-up plenum.

Mandrels are available for welding foils of .003" up to sheet stock of .250". Mandrels are furnished for welding ferrous, non-ferrous, austenitic and ferritic metals. Various models are designed to facilitate positioning of tubular, flat or rectangular shapes and are rotatable and interchangeable. Copper, steel or stainless steel back-up bars are furnished with weld "drop-thru" grooves to control weld root bead, size and contour. Many models are furnished for inert gas backing, featuring a plenum gas reservoir. Inserts are provided with orifices for uniform gas distribution along the weld. Many of these models are designed for normal "chill-shunt" weld tooling principles while others employ thermostatically controlled heating or water cooling.

Stainless steel and steel back-up inserts are for use in welding non-ferrous materials such as aluminum and magnesium alloys. Copper back-up inserts are used for welding steel, stainless steel, titanium, tantalum, molybdenum, zirconium, beryllium-copper, etc.

Write for complete information on Airline Longitudinal Welding Positioners and accessory equipment.

MODEL 1063B water cooled welding back up mandrel commonly used for high production submerged arc and MIG welding applications. Equipped with two removable copper back up inserts.

MODEL 1460A heavy duty welding back up mandrel designed for welding large cones, cylindrical shaped objects and flat sheet.

MODEL 1060A heavy duty welding back up mandrel equipped with one copper back up insert. Designed for welding large diameter and long (up to 12" O.) heavy walled cylindrical objects.

MODEL 1662-4 thermostatically controlled pre-heated mandrel for use in welding medium alloy steels. Equipped with one removable copper insert and gas back up plenum.

MODEL 1121A small diameter welding back up mandrel equipped with one removable copper back up insert and gas back up plenum. For welding small diameter tubing.

All illustrated mandrels are interchangeable in all Airline Longitudinal Welding Positioners.

Airline

WELDING AND ENGINEERING

760 NORTH PRAIRIE AVENUE, HAWTHORNE, CALIFORNIA

MERRILL MB BROTHERS

MATERIAL HANDLING DEVICES

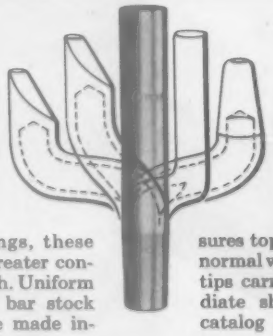
- Safety Factor—5 to 1
- Factory tested at triple rated capacity.
- Will lift from horizontal or vertical position.
- Cam and Pads of case hardened tool steel.
- All operating parts replaceable when worn.
- Swinging or jerking loads will not affect grip.
- Useful for positioning in welding operations.

The HEAVIER the LOAD . . . . . the TIGHTER the GRIP! 3-T-17

MERRILL BROTHERS

56-81 ARNOLD AVE., MASPETH, N.Y.

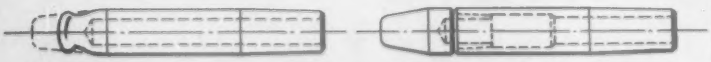
Are You Yet Using Cast Tips?



TUFFALOY
Cold-Formed Tips
Are The Answer

Compared to castings, these Tuffaloy tips show greater conductivity and strength. Uniform high quality of the bar stock from which they are made insures top performance under all normal welding pressures. Many tips carried in stock for immediate shipment. See Tuffaloy catalog for this wide selection.

TUFFALOY® Spotwelding Tips



Are You Throwing Away 90% of Worn, Mushroomed Tips?

With Tuffcap®, You Replace Small Tip only, Re-use Shank

With care Tuffcap shanks outlast many Tuffcap tips, interchangeable in four standard nose designs. Tips are easily replaced, reducing holder wear and down-time of machine.

Tuffaloy resistance welding alloy products are widely available through Airco and Tuffaloy representatives. Call on them for SPOTWELDING TIPS (Standard, 'Tuffcap', Cold-Bent, and Special), Holders and Adapters, BAR STOCK, FORGINGS, SEAM WELDING WHEELS, and all other welding alloy needs. Ask for Catalog and Price List.

AIRCO®

AIR REDUCTION SALES COMPANY
A Division of Air Reduction Co., Inc.
150 East 42nd Street, New York 17, N.Y.

Linde develops high pressure immersion pump

The ability of the HP-8 immersion pump to deliver liquid nitrogen and oxygen at high pressure makes it an important addition to the rocket and missile industry claims its developer, Linde Co., New York City.

The new pump can deliver 11,000 standard cu ft of nitrogen per hour, and can deliver oxygen at a rate of 13,750 scfh at 10,000 psi. Standard packings in the reciprocating, single-action, positive displacement type pump have been replaced by a non-metallic, self-lubricating packing to reduce friction.

Speed of the 15 hp, 440 volt, 60 cycle a-c electrical motor is 1,750 rpm with a 1:8 reduction gear. Sale of the pump at present is limited to the armed forces and companies under contract to the armed forces.

Truecast foundry named Ampco licensee

Truecast, a division of Pointer Tool Co., Louisville, has been appointed a licensee foundry by Ampco Metal Inc., Milwaukee. Truecast will produce the various grades of Ampco metal as investment and permanent mold castings and will use the Ampco trademark.

Nuclear power department formed by Allis-Chalmers

Allis-Chalmers Mfg. Co., Milwaukee, has established a Nuclear Power Department within the recently renamed Atomic Energy Div. The department, under the direction of C. R. Braun, will be responsible for the Division's activities in the nuclear fission field.

HORTON Watersphere fabricated by Chicago Bridge & Iron Co., Chicago, for Northern Illinois Gas Co.'s Joliet district headquarters. Blue gas flames are painted on sides of 95-ft tank.

Direct-to-user sales dropped by OKI

OKI Welding Supply Co., Cincinnati, has dropped its Industrial Sales Div. which handled direct-to-user sales. OKI will continue to sell to distributors and dealers.

The Industrial Sales Div. has been acquired by OKIVA Inc., J. Samuel Fry, president. The new corporation is sharing quarters with OKI, but plans are being made for a separate facility.

Second phase of Lukens expansion program completed

An electric steel-making furnace, second of a three-phase program to expand by 40% the plate rolling capacity of Lukens Steel Co., New York City, has been completed.

Once in commercial production and integrated with other facilities, the furnace will increase the company's rated ingot capacity 24%, from 750,000 to 930,000 tons a year. The furnace melts 100 tons of steel in each heating cycle.

Nine soaking pits, the first phase of the $33,000,000 program, were completed last July. The last phase, a new 140-in. rolling mill, and added soaking pits, will be finished this spring.

LP-Gas sales up 9.4% in 1958

Figures compiled by the Compressed Gas Association, New York City, show that LP-Gas sales in 1958 increased 9.4% over 1957 sales.

The increase of 652,300,000 gallons brought the total gallons sold during 1958 to 7,591,400,000. Domestic and commercial sales were up 15.2%, motor fuel sales 2% and industrial and miscellaneous sales up 9.2%.

BOEING Airplane Co. research engineer demonstrates ceramic material which can withstand more than 4,000 F without melting. Material might be used in missile nose cones. Notice that low heat conductivity allows engineer to hold sample close to flame.

Mrs. Mildred Fisher of John H. Fisher, General Welding, Wilmington, Delaware finds Manganal Bare easy to use to make the strongest welds faster. Manganal Bare has no coating; leaves no slag; eliminates chipping. Workhardens to 550 Brinell; tensile strength 150,000 psi. It is 100% metal; the most effective and economical electrode to use for reclamation welding. The proof is really in the use of Manganal Bare. Try it and see for yourself.

MEMBER NATIONAL WELDING SUPPLY ASSOCIATION

SOLE PRODUCERS

STULZ-SICKLES CO.

929 JULIA STREET • ELIZABETH, N. J.

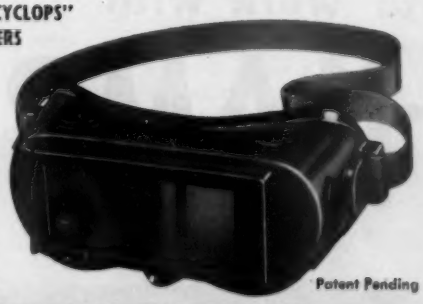
WRITE FOR COMPLETE DETAILS AND NEAREST DISTRIBUTOR

Patent Pending

STYLE 5050—WELSH "SOFT-I" COVER GOGGLES FOR WELDERS

SOFT, LIGHT, PLIABLE WELSH FRAMES PROVIDE NEW COMFORT IN EYE PROTECTION

STYLE 5070—WELSH "CYCLOPS" EYE SHIELDS FOR WELDERS with simplified lens holder.



Patent Pending

WELSH MANUFACTURING COMPANY
9 Magnolia Street, Providence, R. I.

For welding ideas that are "out of this world!" ...

visit our booth (No. 122) at the Chicago International Amphitheatre, April 7-9

Through research ....a better way

A.O.Smith CORPORATION

WELDING PRODUCTS DIVISION

Milwaukee 1, Wisconsin.

SEE HI-AMP with T.P.C. ADDED

AWS Welding SHOW BOOTH 903

APRIL 7, 8, 9 CHICAGO, ILL.

IT'S A PLEASURE

to work with

HI-AMP

ELECTRODE HOLDERS

LENCO, INC.

JACKSON, MISSOURI

FOR YOUR WELDING JOB — WHETHER IT BE LARGE OR SMALL — INSIST ON HI-AMP. THEN YOU'LL BE ASSURED OF GETTING THE BEST MONEY CAN BUY AT THE LOWEST COST.

Pipeline News

Federal Power Commission authorization has been given Texas Gas Transmission Corp., Owensboro, Ky., Natural Gas Storage Co. of Illinois, Chicago, and Cities Service Gas Co., Oklahoma City, to construct unrelated facilities at a total cost of $23,516,771.

Texas Gas will construct 126 miles of various diameter pipeline loops, install additional horsepower in existing compressor stations, add a new compressor station and miscellaneous equipment.

Natural Gas will build 12 injection-withdrawal wells, 2.5 miles of gathering lines, a compressor plant and three observation walls at a cost of $2,560,133. New facilities will be used for injection of gas into new formation at company's reservoir in Kankakee County, Ill.

Cities Service will spend $787,000 to build two new compressor units.

Atlantic Seaboard Corp., Charleston, W. Va., will construct and operate 23.7 miles of 26-in. loop at a cost of $2,448,000, says FPC.

Permission has been given American Louisiana Pipe Line Co., Detroit, to construct and operate 28 miles of 12-in. lateral line at a cost of $1,523,000.

Safety engineers meet at Linde seminar

Safety engineers of the California Div. of Industrial Safety gathered recently in San Francisco for a special all-day seminar sponsored by Linde Co., New York City, to discuss safety practices for newly-developed equipment and processes.

Safety discussions covered manufacture, transportation and use of industrial gases in liquid and gaseous form. Proper use of welding and cutting equipment was demonstrated and requirements for protective clothing, ventilation and eye protection were outlined.

Distributor appointments

Harnischfeger Corp., Milwaukee: Welder Supply Co., Inc., Richmond; Brammer Welding Supply Co., Lynchburg, Va.; A-D Machinery Co., Inc., Elko and Las Vegas; Grand Rapids Welding Gas & Supply Co., Grand Rapids, Mich.

Ampco Metal Inc., Milwaukee: Lewis Industrial Supply Co., Louisville; American Oxygen Service Corp., Harrison, N. J.

Rivett Lathe & Grinder, Inc., Boston: Scott Equipment Co., Wheeling, W. Va.

About people...

The board of directors of P. R. Mallory & Co., Inc., Indianapolis, has added former vice president *Leon Robbin* to its group.

National Cylinder Gas Div., Chemetron Corp., Chicago, has made six field promotions. *Russell C. Rothweiler* now manages the Kansas City, Kan., district office, replacing *Kenneth G. Dieker*, who is working with the company's subsidiary in Caracas, Venezuela. *R. C. Weiss* is the new manager of the Grand Rapids, Mich., office, *C. E. Bodin* has replaced him as acting branch manager in Billings, Mont. *Paul R. Greiling* is now assistant manager in the Chicago sales office, his former position as sales assistant for the midwest region has been filled by *Donald J. Thor*.

Robert D. Warde has been transferred from Venezuela to Mexico City by National Cylinder Gas International, Div. of Chemetron Corp., Chicago. He serves as co-manager and vice president of the five gas companies in which NCG recently purchased interest. The firms are Argon de Monterrey, S. A., Electrodos Monterrey, S. A., and Cia. Productora de Oxigeno, S. A. all in Monterrey; Oxigeno de Chihuahua, S. A., Chihuahua, and Gases y Electrodos, S. A., which has branches in Torrean, Guadaljara and Culican.

Aluminum Co. of America, Pittsburgh, has named *George R. Gent* to the newly created post of manager of welding, brazing and soldering products sales.

Charles D. Scribner has been selected vice president of personnel at Vickers Inc., Detroit, Div. of Sperry Rand Corp.

Gerald C. McKenzie has joined Smith Welding Equipment Corp., Minneapolis, as general sales manager.

Raymond H. Tune is sales manager for Atlas Welding Accessories Inc., Ferndale, Mich. He will head sales of the wholesale jobber and manufacturing divisions.

William B. Nicholson has been appointed a vice president of Linde Co., New York City. Replacing him as vice president—gas products, is *Robert F. Flood*.

Gilbert L. Cox has joined the staff of Whitehead Metals Inc., subsidiary of International Nickel Co., Inc., New York City, as technical director. He will headquarter in the company's Rochester office.

Starting with the new year Tweco Products Inc., Wichita, Kan., made several changes in its territory assignments. *Fred Flint* is now West Coast district manager, *Tom Burke* is north-central district manager and *Glenn E. Smith* is south-central district manager.

Rankin Mfg. Co., Alhambra Calif., has named *Edward C. Smith* midwest district manager in charge of Ranite and Ranomatic hardfacing sales. At the same time *Clarence A. Nielsen* was appointed district manager in the northeastern section of the United States and Canada.

Smith

Nielsen

Norris L. Goodfriend has been appointed sales representative in south Texas and the Lake Charles, La., section by United Specialties Inc., El Dorado, Ark.

Arcos Corp., Philadelphia, has named *James A. Brickett* sales manager. He is responsible for all sales including distributor, export and direct sales efforts.

Holder

New president of Contour Marker Corp., Compton, Calif., is *John H. Holder*. He succeeds the late *K. D. Bryant*. Holder is a welding engineer and has been with the company since its inception in the early 1940's.

Jack B. Laramy has been appointed sales manager of Worthington Corp.'s Harrison, N. J. division. He is the former assistant manager, marketing division, and eastern regional sales manager. He has been replaced by *Patrick L. McManus*. *William M. Fine* replaces McManus as manager of the San Francisco district office.

Charles F. Paxton has been named assistant general sales manager of Weltronic Co., Detroit. He is co-author of the book, "The control and resistance welding."

First president of the recently formed Society for Applied Spectroscopy is *William J. Poehlman* of A. O. Smith Corp., Milwaukee.

James M. Golden is the new vice president, western division, of Titan Metal Mfg. Co., Bellefonte, Pa. He will headquarter in the company's new brass rod mill plant in Newark, Calif., and will direct all Titan activities in 11 western states.

Frank U. Hayes has been appointed president and general manager of Sperry Products Inc., Danbury, Conn. Ultrasonics in the field of nondestructive testing was introduced to the industry by Sperry in 1945. Hayes plans to expand the firm's ultransonic and other products in 1959. Emphasis will be placed on the use of ultrasonic testing products in the industrial, military and missile fields.

McKenzie

Tune

Goodfriend

Brickett

Golden

Hayes

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ALUMINUM
WELDING WIRE
• deposits uniformly
• eliminates interruptions
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All-State Bright Wire Spoolarc, extruded and precision spooled, is uniformly round, microscopically clean . . . meets aviation, tankage, and shipbuilding standards.
Send for booklet and chart on all types and forms of aluminum in BRIGHT FINISH . . . including 1 lb. and 10 lb. spools. Stock maintained at St. Louis, South Gate, Calif., Toronto, Canada, and White Plains, N. Y.
ALL-STATE WELDING ALLOYS CO. INC. WHITE PLAINS NEW YORK

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HIGHEST QUALITY

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AT THE FRONTIERS OF PROGRESS YOU'LL FIND AN AIR REDUCTION PRODUCT

W. B. Moen is manager of engineering for the newly formed Special Products Dept. of Air Reduction Co., Inc., at Union, N. J. He was assistant director of metallurgical research at the company's Murry Hill, N. J. laboratories. At the same time *Dr. Albert Muller* was named vice president of the company's industrial gases and welding products division. At one time Dr. Muller was with the National Academy of Sciences, War Metallurgy Committee.

Died . . .

Mr. Taylerson

Among the victims in the tragic Feb. 4 airliner crash at La Guardia Airport, New York City, was *J. E. Taylerson, 43,* manager of engineering service for Linde Co.'s New York City district office. Killed with him was his wife Florence. Mr. Taylerson was with Linde for almost 14 years, prior to which he was employed by Federal Shipbuilding and Drydock Co., Port Newark, N. J. A metallurgical engineering graduate of the University of Michigan, Mr. Taylerson also attended Carnegie Tech. The Taylersons are survived by their four children.

The field secretary of the American Institute of Mining, Metallurgical and Petroleum Engineers, *Roy E. O'Brien,* died January 9, at the age of 60. Mr. O'Brien spent most of his lifetime mining copper and phosphate. When a heart condition forced him to retire from mining in 1950 he joined AIME as western secretary of the mining branch. He was named field secretary in 1953

David Arnott, former vice president and chief surveyor of the American Bureau of Shipping, New York City, died January 29, at the age of 80. In 1941 Mr. Arnott was awarded the Miller Memorial Medal for outstanding contributions to the art and science of welding by the American Welding Society. In 1947 the Society of Naval Architects and Marine Engineers awarded him the David W. Taylor Medal for achievements in naval architecture. Mr. Arnott also edited and authored many books and articles on ship construction.

30 YEARS AGO

(Taken from the WELDING ENGINEER of March, 1929.)

—30 YEARS AGO—

"The age of speed," a movie produced by Industrial Film Service Co., was shown to students of the Cleveland Welding School. The film pictured planes traveling 246 mph, automobiles going 108 mph and trains doing 60 mph.

—30 YEARS AGO—

Article reports on weldor who used welded scrap pipe to construct the framework for a two-car garage. Article also tells of other applications where welded pipe can be used.

—30 YEARS AGO—

Structural welding was discussed at the last meeting of the Detroit Section of the American Welding Society. A. M. Candy, Westinghouse Electric & Mfg. Co., H. M. Priest, American Bridge Co. and J. C. Lincoln, Lincoln Electric Co., presented papers.

—30 YEARS AGO—

Erection of steel framework for an addition to the Ohio Valley General Hospital, Wheeling, W. Va., is proceeding with no disturbance to patients or doctors. Why? Because workers are using silent electric arc welding in fabrication.

—30 YEARS AGO—

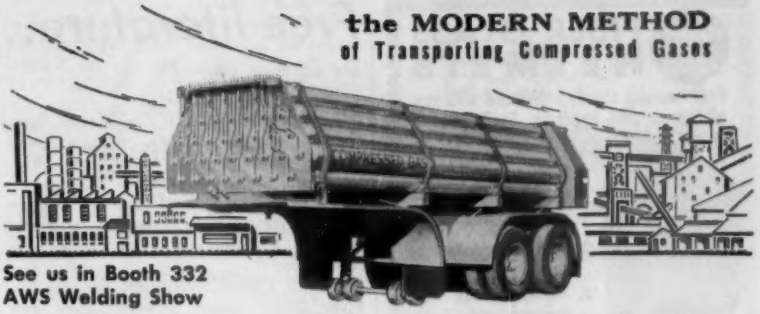
Pallady Welding Co., Portland, Ore., has developed a portable welding shop which is used for various types of field operations. Gas driven arc welders and oxy-acetylene equipment are mounted on rear of an open truck.

—30 YEARS AGO—

Lincoln Electric Co., Cleveland, has appointed G. M. Taylor its new sales manager.

—30 YEARS AGO—

Williams Hardware Co. and Smith Welding Equipment Corp., Minneapolis, recently conducted a four-day welding school. V. L. Sage, Commercial Gas Co., and Stuart Plumley, Smith Welding, were among the speakers.



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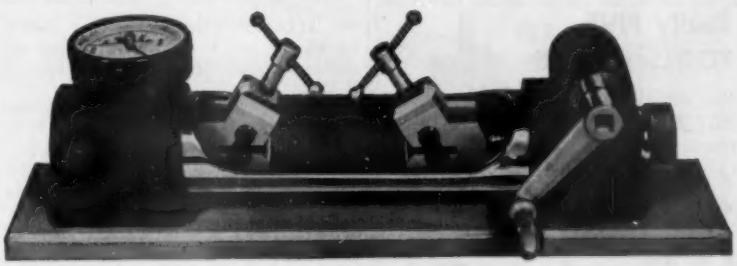

For shop or field—a new

Portable Tensile Tester

Use this compact, precision tensile tester to test strip steel, wire, bolts, spot welds, or anything else within its 4,000 lb. capacity. Besides its use for inspection work in the shop, this portable device provides a convincing method of demonstrating the tensile strength of various materials in sales demonstrations and trade shows.

Only a moderate pull on the crank is sufficient to apply the maximum load. Results are easily read from the load gauge. Simple to use, anywhere, any time. Write for catalog sheet and price.

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DIAL SET LEVEL

Weighs only 9 ozs. Pocket size.

Y type head accurately machined with tangents and tips for centering and aligning. Dial Set Level in graduations of 2½ and 10 degree markings. Punch of Drill Rod with hardened point—insuring long service. Send for complete description.

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Also Mfgs. of Contour Markers, Radius Markers and Pipe Flange Aligners.

BOYCE CENTERING HEAD

Free literature..

use card on page 89

51. HANDLING DEVICES—Merrill Bros. Booklet describes lifting, dragging, and other types of clamps. Includes specifications and parts list numbers.

52. ALUMINUM SOLDER—Ultralloy Corp. Flyer explains Ultralloy, a solder designed for bonding aluminum to nonferrous metals.

53. ELECTRODES—Lincoln Electric Co. Flyer 7205.1 details Jetweld LH-90 and LH-110 low hydrogen, high tensile electrodes.

54. WASTE DISPOSAL—Handy & Harman. Bulletin 24 describes forms of wastes which can hide deposits of precious metals, how they can be salvaged and sold to help reduce production costs.

55. AUTOMATIC WELDING—Airline Welding & Engineering Corp. Multi-purpose positioners, automatic chucking, travel and ejection machines are detailed in bulletin 5-12-57.

56. STAINLESS STEEL—Tube Turns, Inc. Complete dimensional data on full line of stainless steel welding fittings and flanges is contained in catalog TT600.

57. FLUXES—American Solder & Flux Co. Welding flux for magnesium base alloys, aluminum, cast iron and steel welding and for aluminum brazing are described in bulletin W101.

58. CLAMPS—Albert & J. M. Anderson Mfg. Co. Catalog 49D lists line of welding and ground clamps, gives specifications and pictures.

59. ALLOY F—Haynes Stellite Co. Hastelloy alloy F, said to withstand reducing and oxidizing agents, is explained in brochure F-30,128.

60. WELDING PIPE—Linde Co. "Welding chrome-moly alloy-steel piping," is title of reprint available from company.

61. ABRASIVES—Simonds Abrasive Co. Consumer net prices of diamond wheels and hones are given in catalog ESA-290.

62. TURNING ROLLS—Cayuga Machine & Fabricating Co., Inc. Power and idler turning rolls are subject of bulletin 5713.

63. OXYGEN—National Cylinder Gas Div. Use of oxygen to increase operating efficiency in Tropenas converter is described in information report 15.

64. STEEL BARS—LaSalle Steel Co. Five-page wall chart lists all AISI grades of cold finished steel bars.

65. METAL STAMPINGS—Bettcher Mfg. Corp. Metal stampings available to users of large quantity gas, arc and resistance welding are explained in brouchure.

66. SPOT WELDERS—Robert W. Hoffman Co. Weld-Air-Matic, air power for spot welders, is explained in bulletin 100.

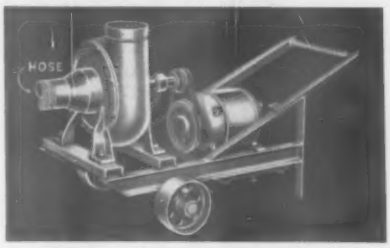
67. LIFTING DEVICE — Harnischfeger Corp. Pictures, graphs and charts are used to describe P&H Zip-Lift machine for various industrial uses.

68. CURTAIN WALL—Nelson Stud Welding. Curtain wall construction using company's stud welding techniques is described in booklet.

69. GAS PUMPS—Linde Co. Folder F-1251 details four pumps for use with liquefied atmospheric gases.

RUEMELIN *Portable* Fume Collector

Removes gas, smoke and heat from welding operations. Recommended for ventilation of tank interiors, manholes, vats, airplane fuselages or for blowing fresh air into inaccessible places.



• Collector is equipped with a power unit capable of handling up to 35 ft. of steel tubing. Mounted on rubber tired wheels for ease of handling. Models also available mounted on steel legs for hose operation in a complete 360 degree circle.

• This view shows inlet hood picking up welding smoke. Operator breathing zone protected.

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WELDING ENGINEERS

MACHINERY BUILDERS

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70. FUSION WELDING—Welduction Corp. Radial welders, automatic controls, positioners and other equipment for fusion welding are covered in brochure.

71. WELDING EQUIPMENT — Bernard Welding Equipment Co. Electrode holders, hose cable assembly and adaptor and welding equipment cooler are detailed and pictured in flyer.

72. INERT GAS WELDING — Vickers Electric Div. Inert gas spot welding timer unit and control units are detailed in bulletin 7002.

73. TORCH TIPS—American Torch Tip Co. Full line of adaptors, washing and heating tips are pictured and specifications given in brochure.

74. TORCHES—Tec Torch Co., Inc. Specifications and tungsten and gas nozzle sizes for company's water cooled Tig torches are given in bulletin 5025.

75. CONTOUR PIPE CUTTER—Steffan Engineering. Mechanical Draftsman, contour pipe cutter that does not need cams or templets, is explained in booklet.

76. CUTTING GAS—Acetogen Gas Co. Advantages and uses of cutting gas are given in folder.

77. FLUXES AND METALS—Alcoa. Wall chart lists characteristics of commonly used filler metals, fluxes, brazing sheet and rod, and brazing alloy flux combinations for aluminum welding.

78. GUN AND CONTROL—Air Reduction Sales Co. Midget air-cooled, 200 amp, continuous duty gun and control, model AH20-B, are detailed in catalog supplement.

79. POSITIONERS—Unique Equipment Inc. Automation for welding, its advantages and applications, is subject of booklet.

80. HEAD CONTROL—Pandjiris Weldment Co. Twelve-directional welding head control is pictured in bulletin 4457. Diagram and specifications are included.

81. TRACTOR REBUILDER — Wincar Welders. Traktorol, for automatically rebuilding tractor rollers and idlers, is covered in flyer.

82. WELDING ACCESSORIES — Tweco Products. Electrode holders, ground clamps, cable connectors, splicers, etc., are detailed in catalog supplement CP-58.

83. ELECTRODE HOLDERS — Jackson Products. Catalog 1020 covers company's full line of electrode holders.

84. ELECTRODE CHART — Champion Rivet Co. Welding electrode comparison chart compares 15 companys' mild steel, iron powder and special purpose electrodes.

85. WELDING FITTINGS — Babcock & Wilcox Co. Technical data card FDC-250 supplies weights of eight different types of welding fittings in full list of sizes.

86. POWER PACK—KSM Products Inc. Booklet gives instructions for running power pack unit to provide direct current to stud welding arc.

87. GAS CYLINDERS — Pressed Steel Tank Co. Description, standard sizes and advantages of company's tanks for industrial and medical gases appear in catalog 1129.

88. TORCHES—Arcair Co. On-job pictures, and description of company's torches are given in bulletin 6-2.

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Cadillac

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BLOWTORCH

Here's a big, efficient blowtorch for all kinds of heat treating and production processes—yet it is completely and easily portable. Operates economically on either natural or manufactured gas. Produces heat up to 2200° F. in seconds! 1/3 h. p., Universal Motor. Sealed, precision ball bearings require no oiling. Equipped with metal stand, 8 ft. of gas hose and 20 ft. of reinforced rubber covered Underwriters' Approved cord with plug.

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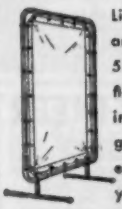
NOW IN 3 CURTAIN MATERIALS:

- ✓ 12 oz. DUCK — fire resistant.
- ✓ NEO-WELD — yellow neoprene-coated fiber glass. Gives greater protection and longer service.
- ✓ ALUMINIZED ASBESTOS CLOTH. Protects by reflection against radiant heat and flame — up to 1400° F.



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Complete line of work gloves, welding gloves and safety clothing.

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ANY Pipe Joint or Structural Angle Cut NOW Layed Out in Just MINUTES!

- Marks off easily and accurately any pipe joint.
- Eliminates all figuring of cut backs, and marks all around pipe.
- Saves man-hours, as well as oxygen and acetylene gas.
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Also Mfgrs. of Boyce Centering Heads, Radius Markers and Pipe Flange Aligners.

THE CONTOUR MARKER

89. RESISTANCE WELDING—Robotron Corp. Progress being made by company in resistance welding, induction heating and electronics is subject of book.

90. RADIOGRAPHY—Curtiss-Wright Corp. Industrial radiography and equipment used are covered in booklet ISP-2-118. Specifications and graphs included.

91. WELDING ALLOYS—Air Reduction Co. Tuffaloy alloys, what they are used to produce, and specifications and pictures of products, are included in catalog 56.

92. ULTRASONIC CLEANING — Narda Ultrasonic Corp. SonBlaster ultrasonic cleaning equipment is described in catalog 104.

93. GAS REGULATORS—OXO Welding Equipment Co. Catalog 55 details gas regulators. Specifications, pictures and graphs included.

94. IMMERSION HEATERS—N. J. Thermex Co., Inc. Therm-X-Red immersion heaters for steel, stainless steel and translucent fused quartz are introduced in brochure.

95. GAS-AIR BURNERS—Selas Corp. of America. Bulletin PR-1 details and pictures company's Multiport P-R Gas-Air Burners for brazing, forming, etc.

96. WELDING CLAMP—Peck Clamps. Flyer diagrams weldor's spatter-proof clamp that applies 8,000 lb pressure.

97. PRODUCTION TIPS—Allis-Chalmers Mfg. Co. Booklet 25B9084 gives 59 ideas on how manufacturers can cut costs in production, storage, etc.

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KEY-BAK
Key-Reel
SAVES WELDERS TIME & MONEY

Retail $2.95

Welders who carry their flint-lighter on a KEY-BAK work faster . . . save, and make more money! Lighter is never lost. It's always handy at the welder's side, on his belt.

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Get KEY-BAK for each welder. KEY-BAK is pocket-watch size, in highly polished chrome finish. Swedish clock spring reels in 24" long STAINLESS STEEL chain. LIFETIME GUARANTEE IN WRITING!

TWO MILLION KEY-BAKS NOW IN USE!

WELDER'S POUCH MODEL
Model 11-W designed especially for welders. Sturdy, genuine-leather pouch designed to hold chipping hammer and other tools. KEY-BAK attached to pouch. Pouch is worn on belt. Retails . . . $6.95

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Good used 244 cu. ft. Oxygen Cylinders.
Good used Acetylene Cylinders, all sizes.
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1—Norwalk 3 Stage Oxygen Compressor.
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Rigidly Specified For
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"UPGRADE" YOUR WELDING OPERATORS. Send them to Hobart's non-profit welding school. Specialized training for code tests and all phases of welding, manual and automatic. Newest and most completely equipped school in the country. Low tuition. Write Hobart Welding School, Box U-392, Troy, Ohio.

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For Air Liquefaction. Installation Oxygen, Nitrogen, Argon gas or liquid production, automatic and standard acetylene plants, inspection and advice for reconditioning old plants.
Proper training of operators for safety and successful and economical operation. Excellent teacher for gas welding, cutting and brazing.
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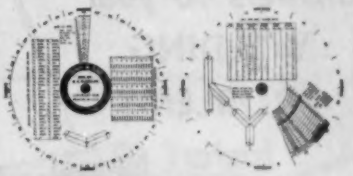

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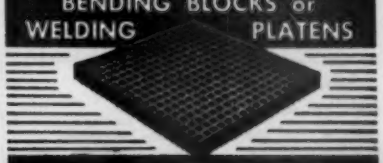

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138. Atlas Welding Accessories Inc.—Write for data on the 33 models of Atlas "Wide Blade" chipping tools.

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143. Curtiss-Wright Corp.—Complete technical details available on the radiographic "Puff Camera."

144. Detroit Testing Machine Co.—Catalog sheets and prices available on the portable tensile tester.

145. Electric Arc, Inc. Write for copy of new brochure, "Smith-Dolan System of Low-Frequency Induction Heating.

146. Fibre-Metal Products Co.—Bulletin No. 65 gives further information on the different models of "Super Grip" electrode holders.

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WHETHER your personal choice is in the cleaned finish or the ground finish, Sylvania makes it available to you through your favorite welding supply distributor.

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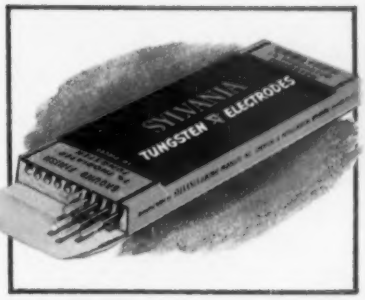
Easiest to use—easiest to get—widest range of applications, these are just a few of the important reasons why more welders use Sylvania Tungsten electrodes than any other brand. Ask your Distributor for Sylvania next time you order electrodes.



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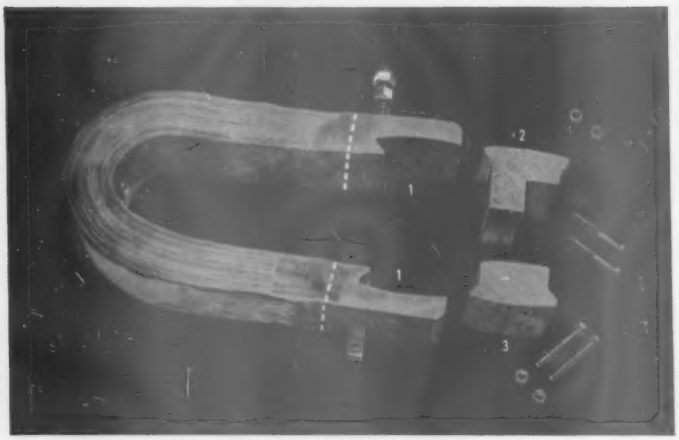
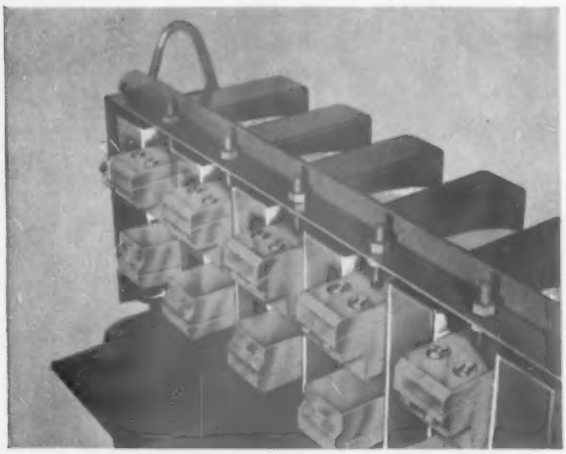


Electric rivet heaters are tough, simple machines that have for years been saving time and money in riveting operations. But Frank C. Cheston Co., Newark, N. J., saw a chance to save its customers some money in maintenance, too, by making electrode-assembly contacts easy to remove for resurfacing or replacement.

Originally these contacts were integral with the laminated copper conductor forming a one-turn secondary in the step-down transformer. In redesign, only parent blocks (1, at left) are welded to the conductor. Contact shoes (2 and 3), which mate precisely with parent blocks for unimpaired conductivity, are easily removed by unbolting*.

Machining pieces 1, 2, and 3 from copper bar stock ran costs so high that the price of the heater would have become unrealistic. American Brass specialists were consulted and precisely shaped extrusions of high-conductivity copper were produced, from which the finished sections are cut. Tolerances were closer and surfaces finer than with machining—and costs per electrode assembly were cut $70.



Close-up of a 5-electrode Cheston electric rivet heater with the new removable contact feature for easier maintenance. Savings from use of Anaconda extrusions enabled Cheston to include this new feature at practically the same price as heaters of previous design.

Cheston electric rivet heater in use showing how step-design of upper contact (2, in illustration above, left) makes it easy to heat both long and short rivets. Contacts are opened by foot pedal and contact pressure is maintained by springs seen just above the pedal.

CUTTING shop costs may be easier than you think. Take a fresh look at the way you're making metal parts. Make a note of any part you suspect might benefit by the use of extrusions, special-shaped tube, die-pressed forgings, etc. Then call in your American Brass Company representative and talk it over with him. He will see that your problem gets to the right Anaconda technical specialists promptly and will expedite the answer. Or write: The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass, Ltd., New Toronto, Ontario.

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